cobas®

Life needs answers

cobas b 221 system

Service Manual

Roche

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Version History

Manual Version	Software Version	Version date	Changes
1.0	1.0	May 2003	First edition
2.0	2.0	March 2004	Chapter 2, 3, 4, 5, 6, 7, 8, 9
3.0	3.01	June 2004	Chapter 2, 3, 4, 6, 8, 9
4.0	4.00	December 2004	Chapter 1, 2, 3, 6, 7, 8, 9
4.1	4.02	July 2005	All chapters
5.0	5.00	November 2005	Parts A, B, D, E, G
6.0	5.00	March 2006	All chapters
7.0	6.00	December 2006	All chapters
8.0	7.00	December 2007	All chapters
9.0	n./a.	May 2009	Chapter 2, 3, 6, 7

Language	Order Number
English	03309614001

For more information, see:
Software on page G-5
Service Manual on page G-6

Edition notice

cobas b 221 system Service Manual

This manual is for the maintenance and repair of the **cobas b** 221 system.

cobas b 221 system

In the course of 2006 the Roche OMNI S system was rebranded under the Roche Diagnostics professional IVD user brand cobas®.

Systems with a serial number of 5001 or above are **cobas b** 221 systems.

Systems with a serial number up to 5000 are Roche OMNI S systems.

Every effort has been made to ensure that all the information contained in this manual is correct at the time of printing. However, Roche Diagnostics GmbH reserves the right to make any changes necessary without notice as part of ongoing product development.

Any customer modification to the instrument will render the warranty or service agreement null and void.

Software updates are done by Roche Service representatives.

Intended use

This manual contains all of the information required for the maintenance and repair of the **cobas b** 221 system.

The user must be familiar with the function and operation of the instrument to fully understand the processes described here.

For more information about **cobas b** 221 system instructions, refer to:
cobas b 221 system Instructions for Use
cobas b 221 system Reference Manual

Observe the service and repair procedures described in this manual and use only genuine Roche replacement parts and Roche-approved materials to guarantee the full functionality of the **cobas b** 221 system.

For the order numbers of replacement parts, refer to the **cobas b** 221 system *Spare Part List*.

For an overview of possible revisions and available software versions, see:
Software on page G-5
Service Manual on page G-6

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Preface

This manual contains all of the information required for the maintenance and repair of the **cobas b** 221 system.

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For an overview of possible revisions and available software versions, see:
Software on page G-5
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How to Use This Manual

- *Keep this manual in a safe place to ensure that it is not damaged and remains available for use.*
- *This Service Manual should be easily accessible at all times.*

To help finding information quickly, there is a table of contents at the beginning of the book and each chapter. In addition, a complete index can be found at the end.

Where to Find Information

In addition to the Service Manual, the following documents are also provided to assist in finding desired information quickly:

- **cobas b** 221 system Instructions for Use
- **cobas b** 221 system Operator's CD
- **cobas b** 221 system Reference Manual
- **cobas b** 221 system Short Instruction
- **cobas b** 221 system Service Manual (PDF or iSDoc version in GRIPS)
- **cobas b** 221 system Spare Part List (PDF or iSDoc version in GRIPS)

Conventions used in this manual

Visual cues are used to help locate and interpret information in this manual quickly. This section explains formatting conventions used in this manual.

Symbols The following symbols are used:

Symbol	Used for	
►	Procedural step	
•	List item	
👁	Cross-reference	
☞	Call up of screen	
	Note	All sections or text locations marked with "NOTE" describe safe procedures that are intended to provide the user with additional help.
	Caution / Warning	All sections / passages that are marked with this symbol describe procedures and/or indicate conditions or dangers that could damage or lead to a malfunction in the **cobas b** 221 system, and which therefore should never be attempted to avoid potential injuries (to patients, users and third parties).
	Biohazard	Risk of infection!
	High Voltage	Passages that are marked with this symbol warn of an immediate danger in connection with electrical wiring or components.
	ESD protection measures	All sections or passages that are marked with this symbol warn of specific dangers in connection with static discharge. Packages that are marked with this symbol must only be opened by trained technical staff.
	Invisible Laser Radiation	Avoid direct radiation to eyes Laser Class 3R according to EN 60825-1 P0 ≤ 5 mW λ = 635 - 850 nm

👁 For more information about warning symbols, refer to the **cobas b** 221 system *Intructions for Use.*

👁 For more information about ESD protection measures, see *ESD protection measures* on page A-8.

Abbreviations The following abbreviations are used:

Abbreviation	Definition
A	
ADC	Analogue to digital converter
ANSI	American National Standards Institute
AQC	AutoQC
B	
BG	Blood Gases
C	
CCD	Charge coupled device
CMOS	Complementary Metal-Oxide Semiconductor
E	
EEPROM	Electrically erasable programmable read-only memory
e.g.	*exempli gratia* – for example
EC	European community
EN	European standard
ESD	Electro Static Discharge
F	
FMS	Fluid Mixing System
FTP	File Transfer Protocol
H	
HIV	Human Immunodeficiency Virus
HW	Hardware
I	
IEC	International Electrical Commission
IfS	Interference sensor (part of the MSS cartridge)
ISE	Ion selective electrode
IVD	In vitro Diagnostics
L	
LCD	Liquid Cristal Display
M	
MC	Measuring chamber
MOS	Metal-Oxide Semiconductor
MSDS	Material safety data sheet
MSS	Metabolite Sensitive Sensor
Q	
QC	Quality control
R	
REF	Reference solution for ISE module
S	
S1	S1 Rinse Solution
S2	S2 Fluid Pack
S3	S3 Fluid Pack A

Abbreviation	Definition
SCD	Sample container detection
SD	Sample distributor
SIP	Sample inlet path
SW	Software
T	
T&D	Turn and Dock
TTL	Transisitor-Transistor Logic
U	
USB	Universal Serial Bus
V	
V19	Valve 19
VM	FMS Mixing Valve
VPP (=VPS)	Vacuum pump protector

System Description A

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Safety information

Before the maintenance and repair of the **cobas b** 221 system, it is essential that the warnings, cautions, and safety requirements contained in this manual are read and understood by the user.

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Deproteinizer 7
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Important information

This **Service Manual** contains vital **warning and safety information.**

This instrument is only intended for one area of application which is described in the instructions. The most important prerequisites for use, operation, and safety are explained to ensure smooth operation. No warranty or liability claims will be covered if the instrument is used in ways other than those described or if the necessary prerequisites and safety measures are not observed.

The instrument may be operated only by persons whose qualifications enable them to comply with the safety measures that are necessary during operation of the instrument.

To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

To avoid direct contact with biological materials, wear lab clothing, protective gloves, protective glasses and, if necessary, mouth cover and apply disinfection and sterilization procedures.

Adjustments and maintenance performed with removed covers and connected power may be attempted only by a qualified technician who is aware of the associated dangers.

Instrument repairs are only to be performed by the manufacturer or qualified service personnel.

Only accessories and supplies either delivered by or approved by Roche are to be used with the instrument. This ensures the performance and measuring accuracy of the unit. These items are manufactured especially for use with this instrument and meet the highest quality requirements.

Operation of the instrument with solutions whose composition is not consistent with that of the original solutions' can negatively affect, above all, the long-term measurement accuracy. Deviations in the composition of the solutions can also decrease the service life of the electrodes.

The quality control requirements must be completed at least once daily for safety reasons. Because the measurement results delivered by the instrument depend not only on the instrument's proper operation but also on a variety of external influences (for example: preanalytics), the results produced by this instrument should be appraised by an expert before additional measures are taken based on the results.

Explanation

*Meaning: Important, see the **cobas b** 221 system Instructions for Use.*

Operating safety information

The instrument has been constructed and tested according to the following European Standards:

- IEC/EN 61010-1
- IEC/EN 61010-2-101
- IEC/EN 61010-2-081 + A1

It was delivered from the factory in flawless condition with regards to safety features. In order to preserve this condition and ensure safe operation, the user must respect the notices and warnings that are contained in this Service manual.

- This equipment is a Class I laser product, and it complies with FDA Radiation Performance Standards, 21 CFR Subchapter J (only valid for **cobas b** 221<1/3/5> systems with tHb/SO_2 module).
- This instrument is classified under the protection class I according to IEC/EN 61010-1.
- The instrument meets the conditions for overvoltage category II.
- The instrument meets the conditions for contamination level 2.
- Do not operate the instrument in an explosive environment or in the vicinity of explosive anesthetic mixtures containing oxygen or nitrous oxide.
- If objects or liquids enter the internal areas of the instrument, remove the instrument from its power supply and allow an expert to check it thoroughly before using it again.
- The instrument is suitable for long-term operation indoors.

- *The power cord may be plugged only into a grounded socket. When using an extension cord, make sure it is properly grounded.*
- *Any rupture of the ground lead inside or outside the instrument or a loose ground connection can render hazardous operation of the instrument. Intentional disconnection of the grounding is not permitted.*
- *The instrument is not suitable for operation with a direct current power supply. Use only the original mains plug delivered with the **cobas b** 221 system.*
- *The use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.*

Important notes and warnings

- *Never operate the analyzer in the vicinity of volatile or explosive gases (e.g. anesthetic gases, etc.)!*
- *The instrument must be connected to a 2-pin, grounded socket.*
- *The power cable and the plug must be undamaged. Damaged power cables and plugs must be replaced immediately.*
- *Before opening the back panel switch off the instrument and disconnect the power cable.*
- *Replace damaged fuses with the specified type of fuse.*

- *Service and repair work must be done only as specified in this manual. Unqualified service or repair work may result in warranty claims not being granted.*
- *Use only suitable tools and test instruments for service and repair work.*
- *Do not allow fluids to enter the interior of the instrument, because this may damage the electronics.*
- *Use only slightly moistened cloths or cotton sticks to clean the instrument.*

Disinfectants

Use only liquid disinfectant such as protein remover (Roche deproteinizer) or an alcohol-based (about 70%) surface disinfectant.

Do not spray disinfectant directly onto the instrument because this could cause malfunctions in the electronics.

Do not use any type of bleaching agent. Exception: Roche Deproteinizer.

Do not attempt to clean/decontaminate any part of the instrument before shutting it down and unplugging it from the power source.

Before plugging in the instrument again and switching it on always wait for 15 minutes to allow the disinfectant to evaporate.

Deproteinizer

Composition Aqueous NaOCl solution with active chlorine (≤ 2%)

Hazards identification Due to the basic and oxidizing character of the reagent ("Deproteinizer") local irritations after contact with eyes, skin or mucous membranes cannot be excluded.

First aid measures

After inhalation:	breath fresh air, drink large amounts of water
After skin contact:	wash with generous amounts of water, remove contaminated clothing
After eye contact:	rinse eyes with generous amounts of water, contact an eye specialist
After drinking:	drink large amounts of water, avoid vomiting, contact a doctor

Other disinfectants

Use standard alcohol-based (70%) disinfectants to clean the surface of the instrument. Read the product information first.

Never use standard disinfectant to clean the tubes and tubing paths under any circumstances!

Do not use any type of bleaching agent. Exception: Roche Deproteinizer.

ESD protection measures

ESD = Electrostatic Sensitive Device

Explanation of the phenomenon

The most frequent cause of electrostatic discharge is friction of various materials such as plastic, synthetic fiber, hard rubber or paper.

It can also be caused by bending or applying pressure to a material.

Discharges that are dangerous to components occur when "charged" bodies or components do not have a discharge connection (ground) to discharge the electrostatic charge.

The discharges normally do not have a high capacity, but there are often voltage differences in the range of several thousand volts. The discharges are perceived as small shocks or visible sparks.

Examples:

- Shoes with rubber soles:

  Friction is caused by walking. A person develops an electrical charge different from the ground. A discharge occurs when an object (e.g. door handle) is contacted.

- Synthetic fiber clothing:

  Discharge is audible and is visible in darkness.

The dryer the air the greater the risk of electrical discharge caused by friction.

Electrostatic charges are less likely to build up in humid air, particularly when saturated with water vapor.

The probability of ESD phenomena is therefore particularly great in a northern hemisphere winter in centrally heated rooms where the humidity is low.

Influence of electrostatic charges on components

If a person with an electrostatic charge touches a component, a discharge over a connection of an IC or semiconductor element may occur. The resulting voltages may damage the component.

Critical situations can occur while repairing or testing components if they are lying on a more or less conductive surface (e.g. table top) and a person with an electrostatic charge touches them. A discharge through a critical component connection can also occur in this case.

Why is ESD protection so important today?

Formerly, current controlling semiconductors were mostly used (TTL, normal transistors, etc.).

Today the principle of current logic is virtually the only technology in use in MOS and CMOS components.

Currents generated by an electrostatic discharge (as much as several kV!) destroy the sensitive component inputs or cause hidden damage. This damage is generally not immediately detectable.

Another effect is that the clearances inside the ICs continuously become smaller. The internal wires become thinner and thinner, the allowable maximum input voltages become smaller and the effects of any discharges become more and more critical.

How can ESD protection be guaranteed?

A continuous discharge is required when working on an electronic assembly. Do this as follows:

- Use ESD wrist bands (special wrist bands connected to a protective ground).
- Repairs and tests on assemblies must only be conducted on tables with ESD mats connected to grounds or ESD wrist bands.
- Always pick up components at the edge (e.g. like a photo).
- Components must always be transported in ESD packages or appropriate storage or shipping containers (use original packaging!).
- Shoes with rubber soles or clothing of synthetic fibers must not be worn in workshops where electronic components are repaired.
- Use a humidifier if necessary to maintain optimum humidity in the work area.
- Do not touch assemblies or components with the hand after testing.
- Always transport and ship assemblies or components for repair in ESD protective packaging only. This will prevent further damage that may result in misinterpretation of the original cause of the fault.

The ESD mat consists of materials that have a very low, defined conductivity (1012 ohms). The following materials prevent charges caused by friction from building up and protect the component from damage.

- *ESD mats*
- *ESD packages*
- *Shipping containers*

Conclusion

Of course, not all circuit boards and electronic assemblies require such careful handling. An electrical board that only carries simple plug connectors does not require ESD packaging.

In cases of doubt always use ESD packaging.

Fluid actions

This chapter provides information about the fluidic actions of the **cobas b** 221 system.

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Fluid actions overview

cobas b 221<1> system

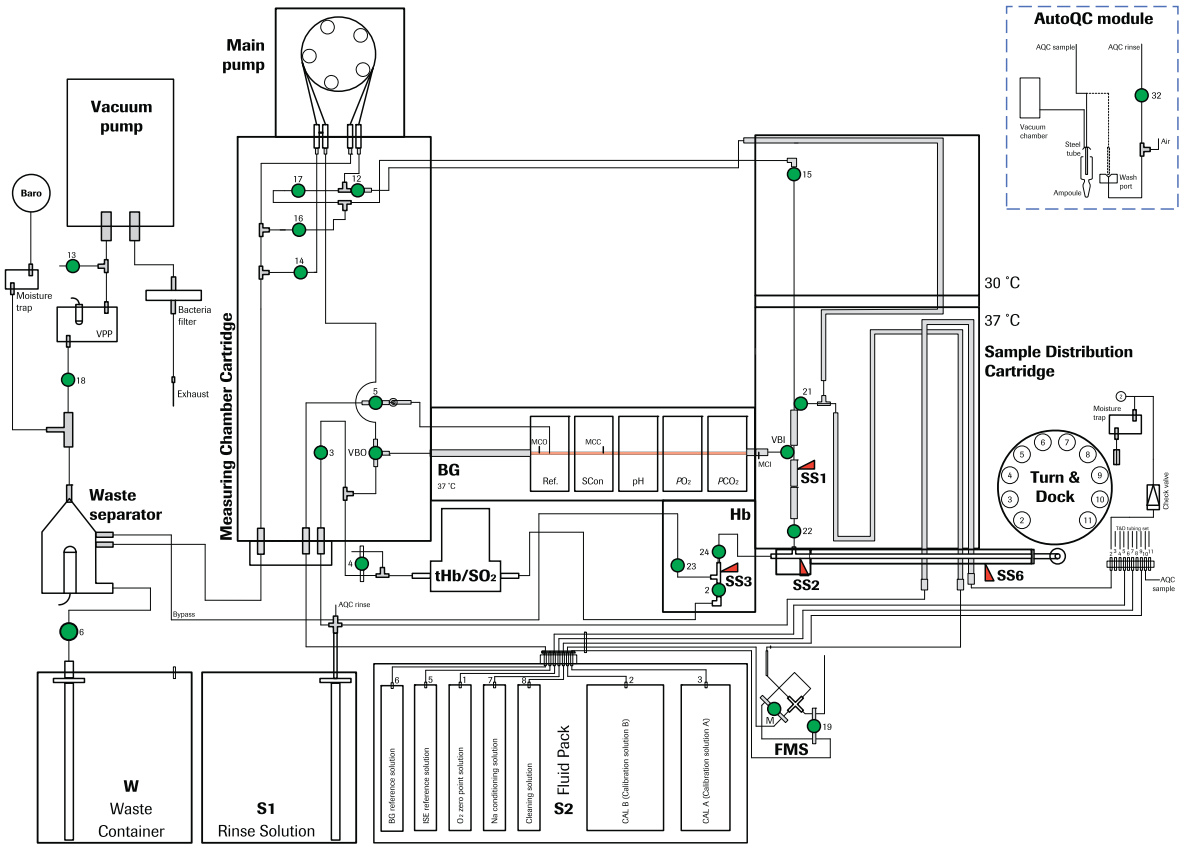


Figure A-1 **cobas b** 221<1> system

cobas b 221<2> system

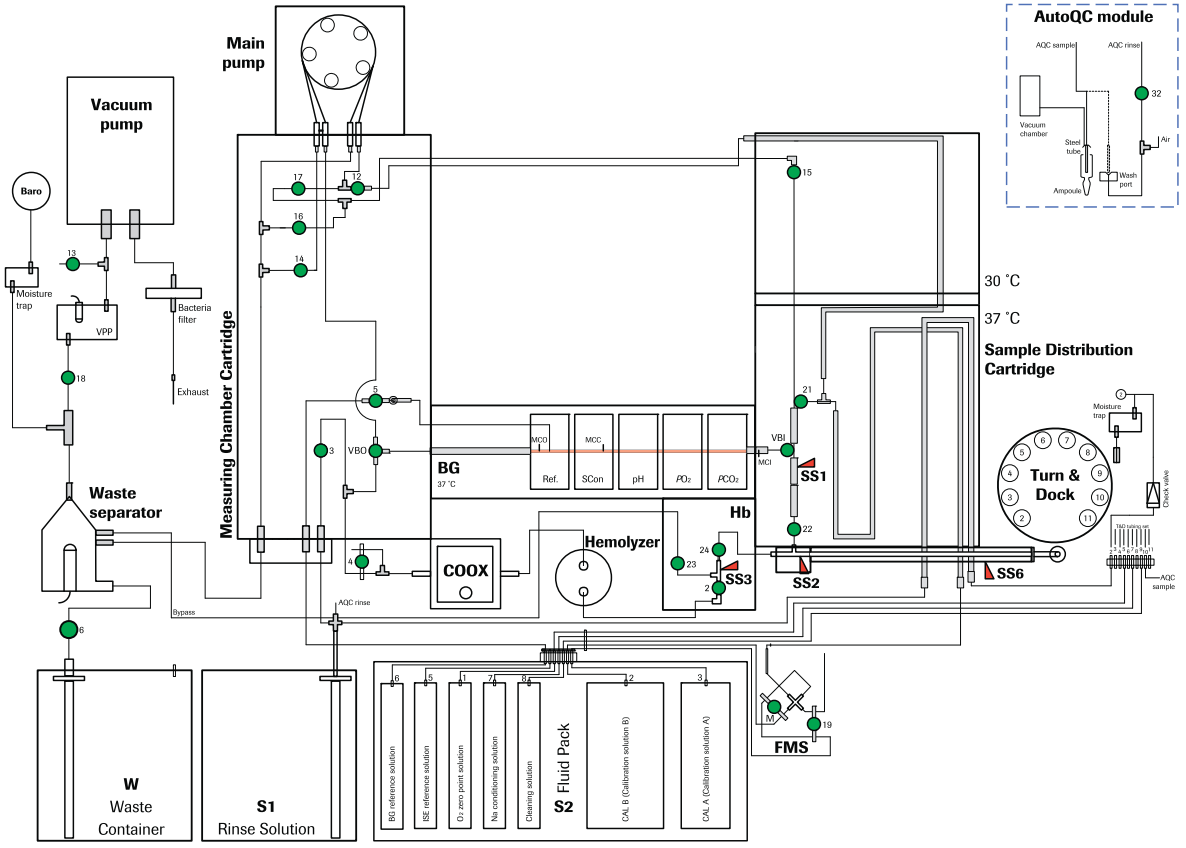


Figure A-2 **cobas b** 221<2> system

cobas b 221<3> system

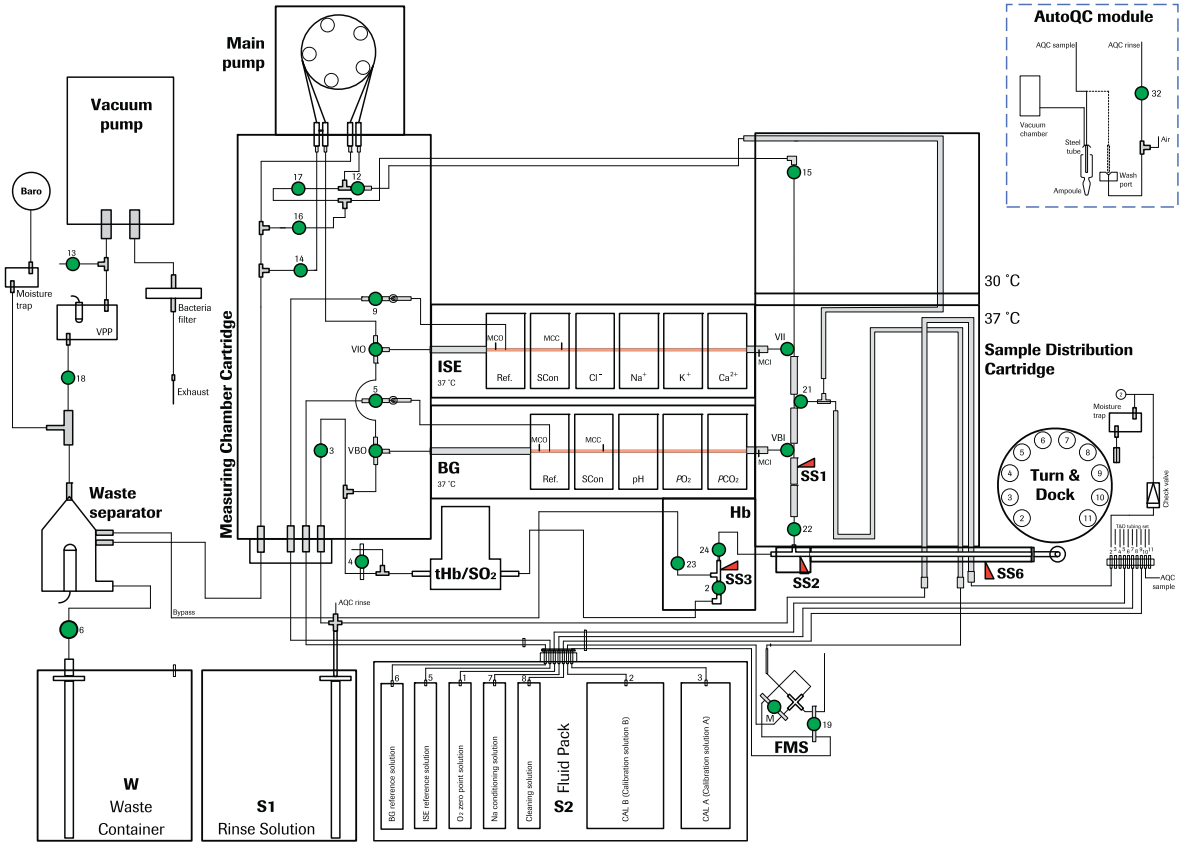


Figure A-3 **cobas b** 221<3> system

cobas b 221<4> system

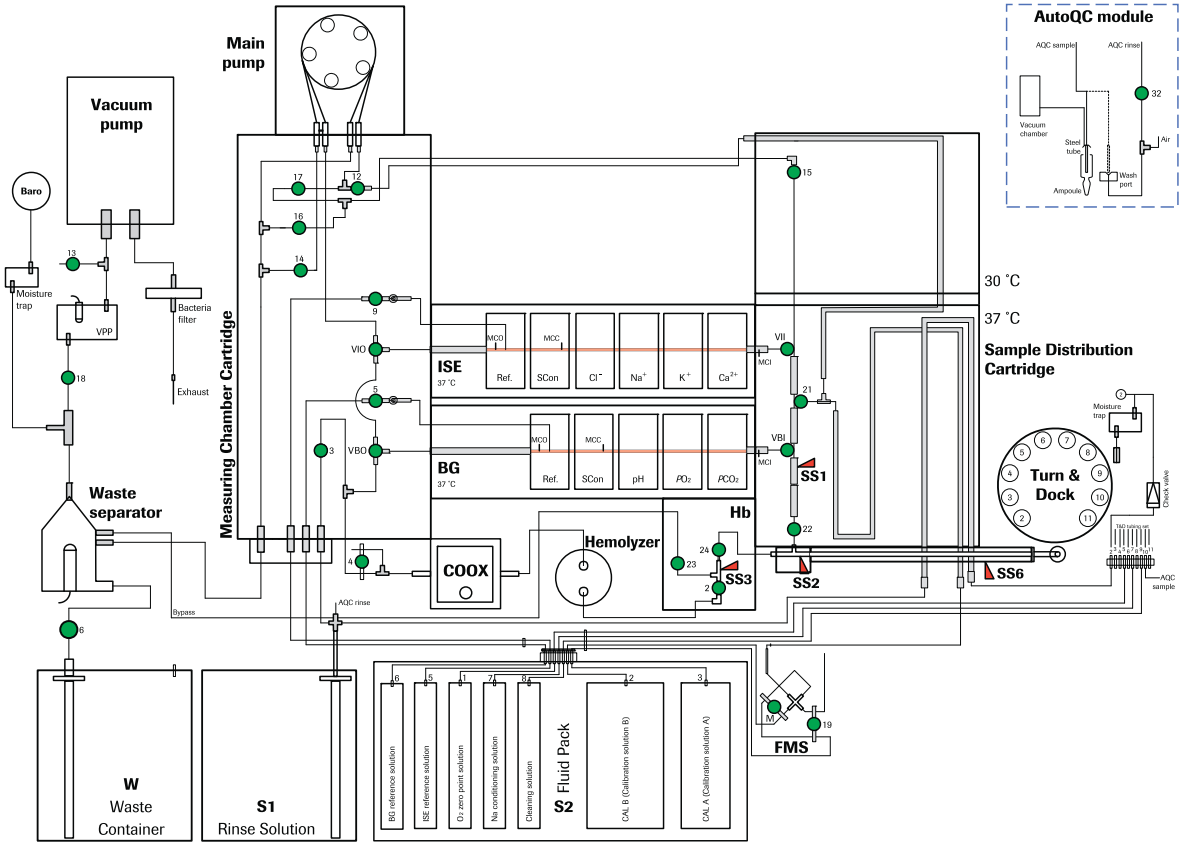


Figure A-4 **cobas b** 221<4> system

cobas b 221<5> system

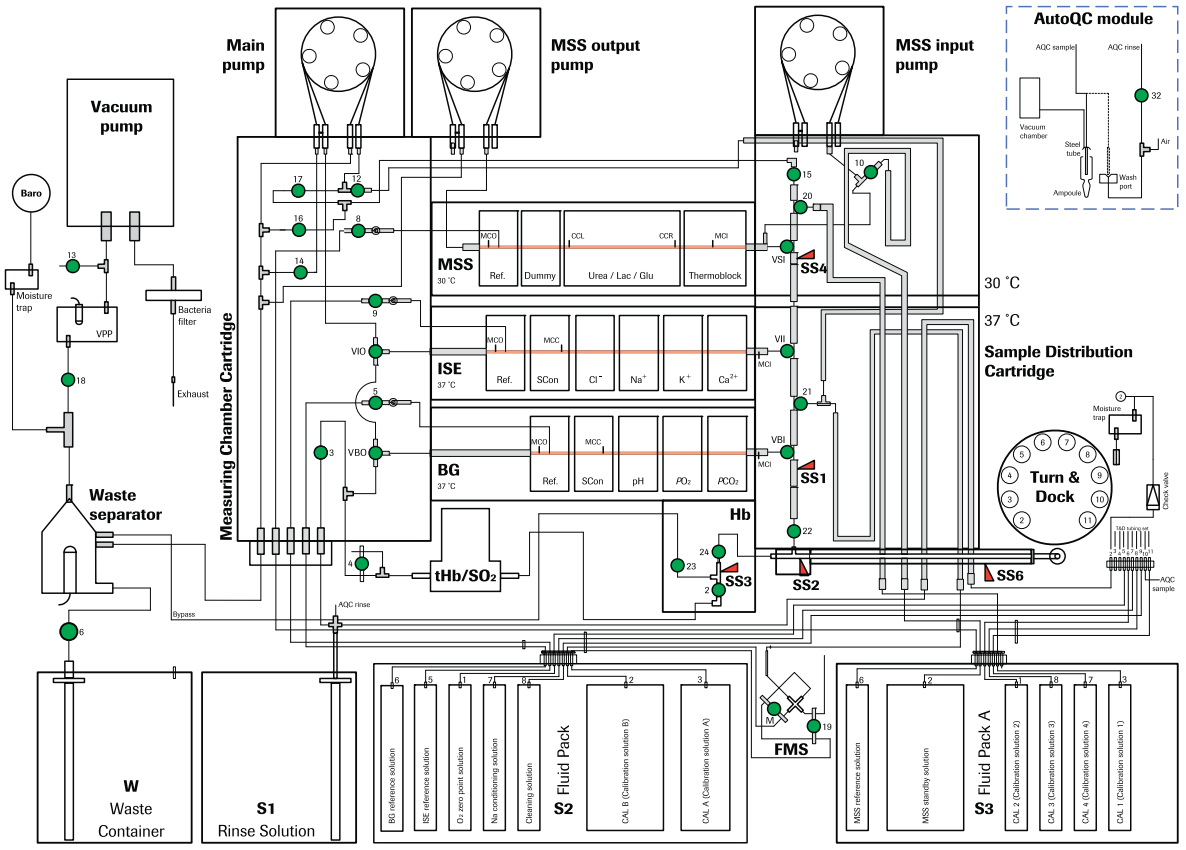


Figure A-5 **cobas b** 221<5> system

cobas b 221<6> system

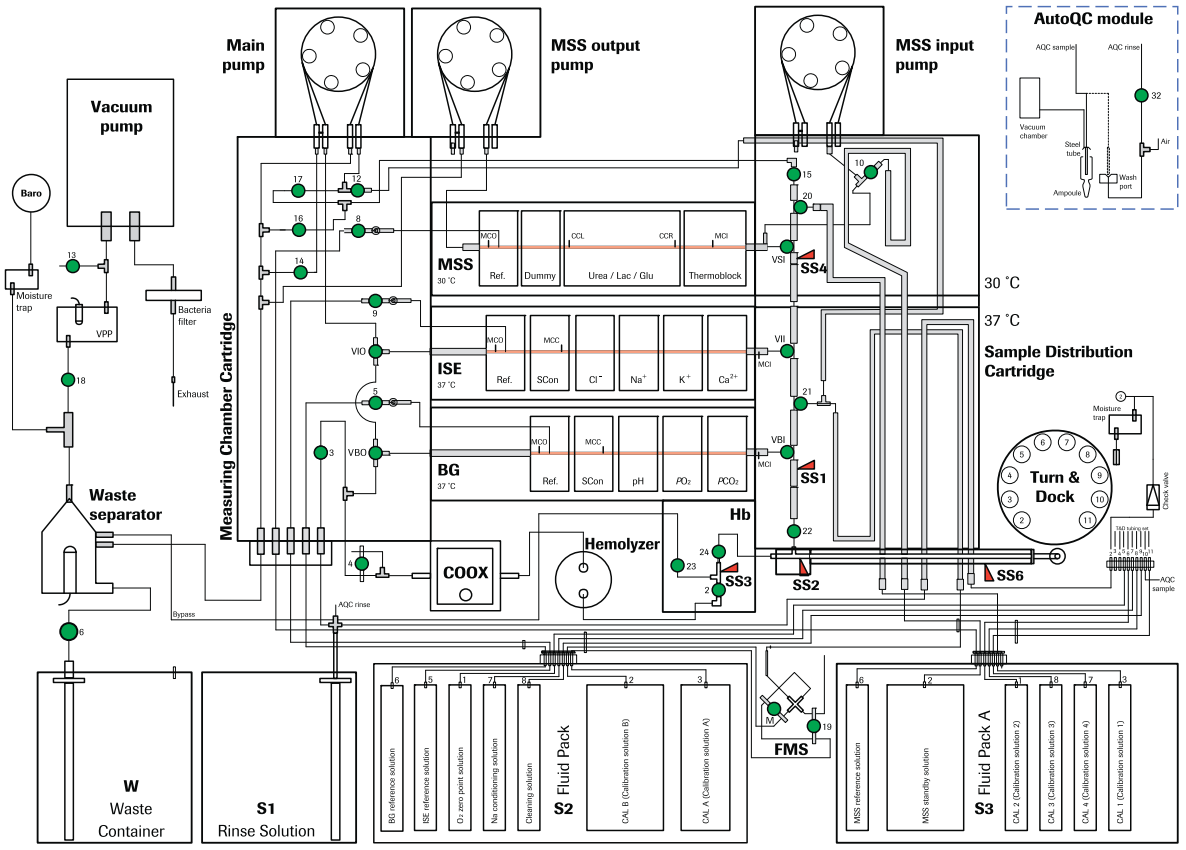
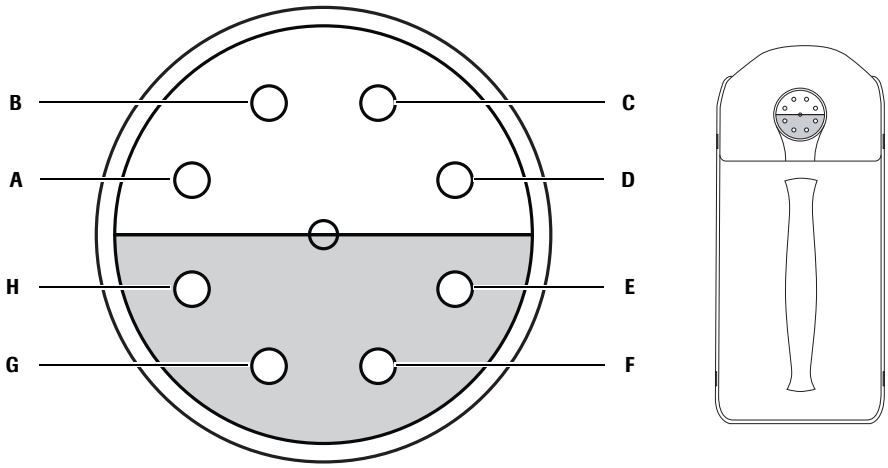


Figure A-6 **cobas b** 221<6> system

Pin assignment of S2 and S3 Fluid Packs

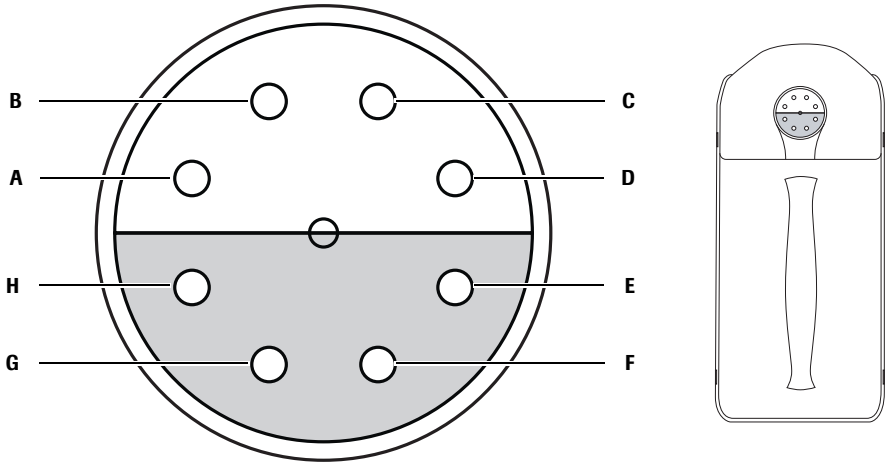
S2 Fluid Pack



A O_2 zero point solution
B CAL B (calibration solution)
C CAL A (calibration solution)
D empty
E ISE reference solution
F BG reference solution
G Na conditioning solution
H Cleaning solution

Figure A-7 Pin assignment of S2 Fluid Pack

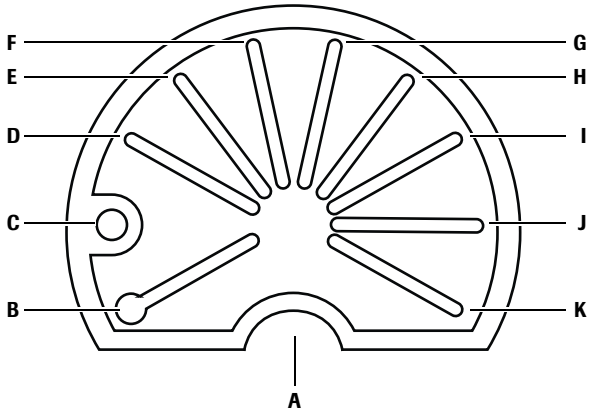
S3 Fluid Pack A (cobas b 221<5/6> systems only)



A CAL 2 (calibration solution 2)
B MSS standby solution
C CAL 1 (calibration solution 1)
D empty
E empty
F MSS reference solution
G CAL 4 (calibration solution 4)
H CAL 3 (calibration solution 3)

Figure A-8 Pin assignment of S3 Fluid Pack A

T&D positions



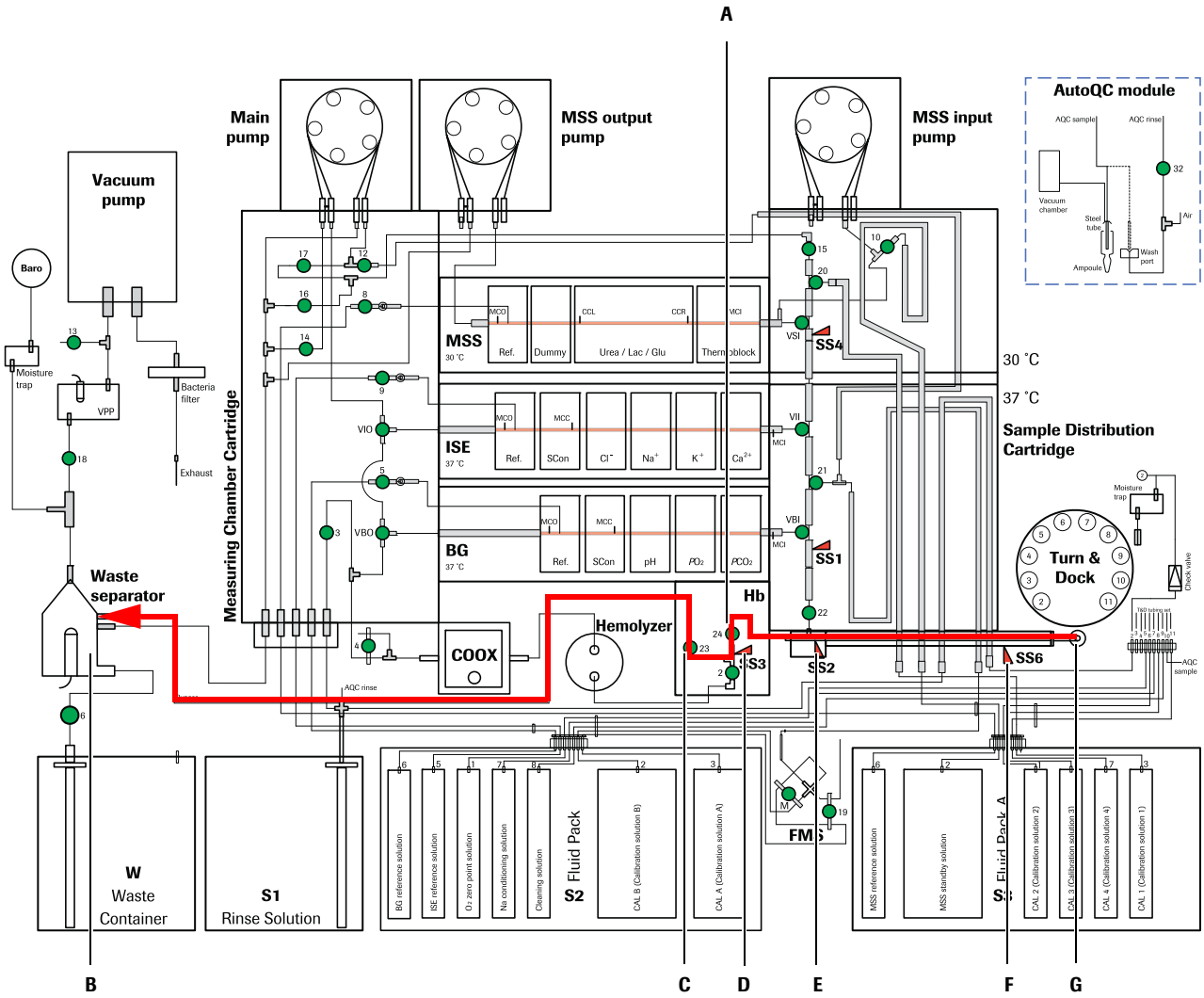
A 1: Releases the fill port for placing a sample
B 2: S1 Rinse Solution
C 3: Position for "aspiration from the syringe“
D 4: Dock position
E 5: O_2 zero point solution from S2 Fluid Pack
F 6: CAL 2 from S3 Fluid Pack A (**cobas b** 221<5/6> systems only)
G 7: Na conditioning solution from S2 Fluid Pack
H 8: CAL 3 from S3 Fluid Pack A (**cobas b** 221<5/6> systems only)
I 9: Cleaning solution from S2 Fluid Pack
J 10: AutoQC connection
K 11: CAL 4 from S3 Fluid Pack A (**cobas b** 221<5/6> systems only)

Figure A-9 T&D positions

Measurement

Sample input

Injecting sample



A	V24	**C**	V23	**E**	SS2	**G**	Fill port
B	Waste separator	**D**	SS3	**F**	SS6		

Figure A-10 Injecting sample

The sample container is detected by a light barrier on the T&D module.

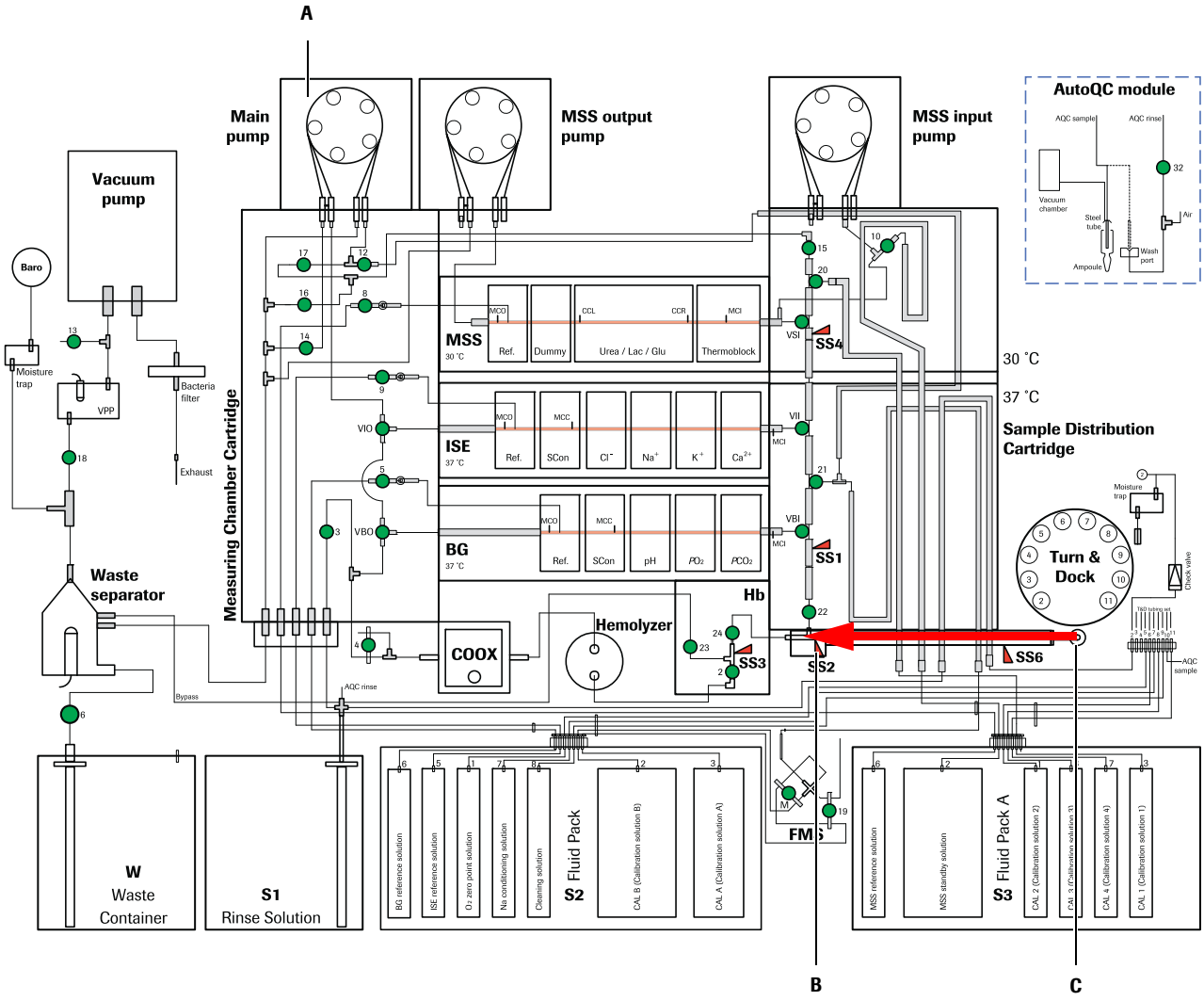
Sample path:

- fill port >
- sample inlet path >
- SS2
- When the sample has reached SS2 the user is prompted (by beeping and prompt window) to remove the sample container.

Excess sample material:

- V24 (open) >
- V23 (open) >
- Bypass >
- Waste separator

Aspirate sample



A Main pump
B SS2
C Fill port

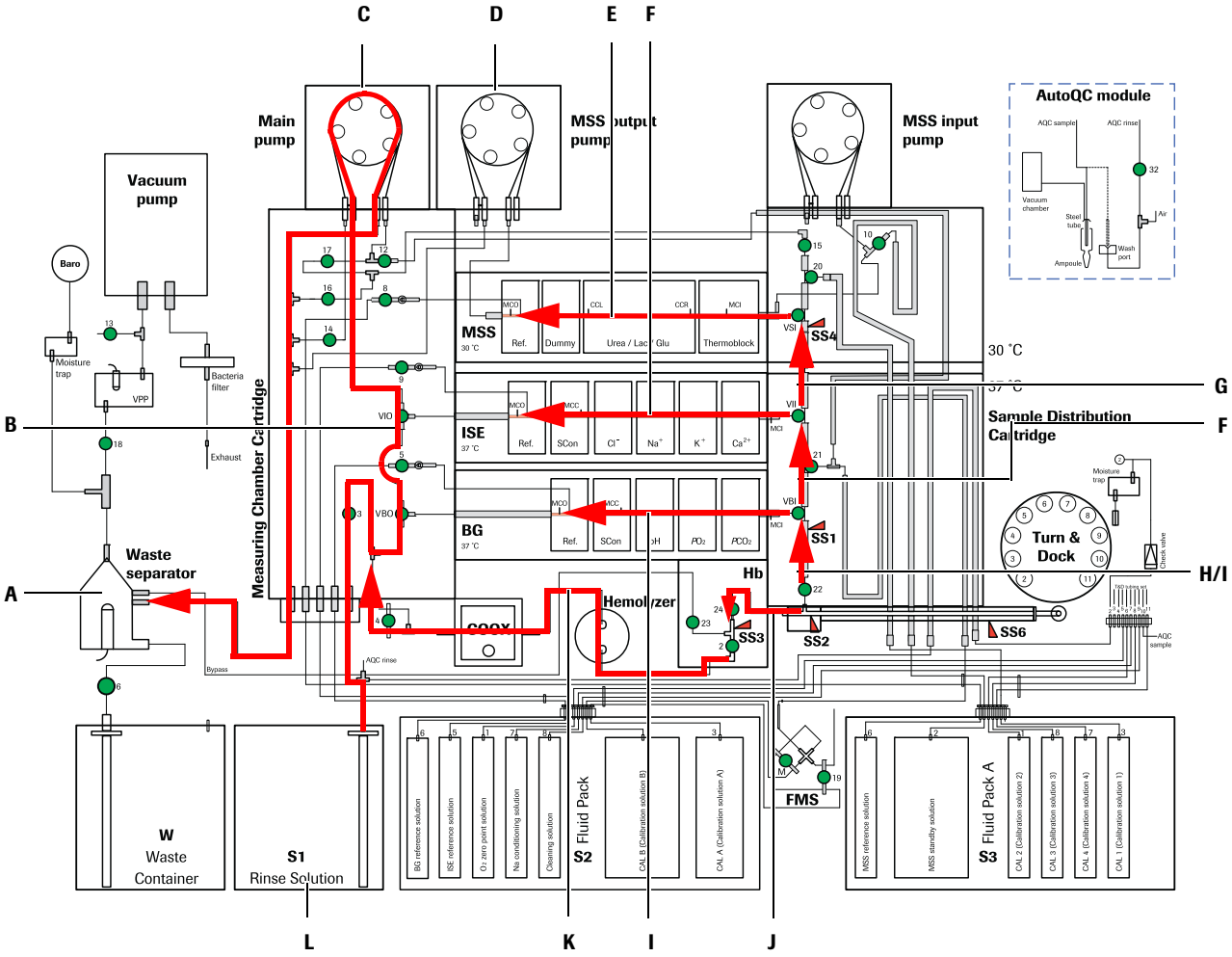
Figure A-11 Aspirate sample

The sample container is detected by a light barrier on the T&D module. The sample is aspirated through the cross channel with the main pump.

Sample path:

- fill port >
- sample inlet path >
- SS2
- When the sample has reached SS2 the user is prompted (by beeping and prompt window) to remove the sample container.

Sample distribution



A Waste separator
B Wash rail
C Main pump
D MSS output pump
E Position MSS
F Position ISE
G Separate MSS
H Separate BG
I Position BG, separate ISE
J Separate tHb/SO_2 or COOX
K Position tHb/SO_2 or COOX
L S1 Rinse solution

Figure A-12 Sample distribution

When the sample is detected by SS2 the sample distribution is started. The sequence of the individual aspiration phases depends on the existing or requested modules.

Separating BG: The start of the sample is aspirated from SS2 to SS1. The volume SS2-SS1 is specified for filling the BG measuring chamber.

Separating tHb/SO_2 or COOX: One sample segment is aspirated from SS2 to SS3. The volume SS2-SS3 is specified for filling the tHb/SO_2 or COOX module.The user can specify in the setup whether tHb/SO_2 / COOX or ISE is separated first.

Positioning BG and separating ISE: This aspiration process assumes that the sample column tip is at SS1. It is aspirated via VBI and VBO with the main pump. The start of the sample movement is detected by the conductivity (breaking of the calibration solution column in the measuring chamber). If this does not occur at the right time, an aspiration error is displayed. The positioning of the sample is controlled by the MCI-MCO contact path. If a timeout occurs because an excessively low signal or a non-reproducible conductivity signal, an aspiration error is displayed. During the aspiration the sample is "observed" with SS1; if the volume of the sample is too small, this interferes with the aspiration process.

After closing the VBI the ratio of the conductivities of MCI-MCO to MCI-MCC is checked. If there are air bubbles in the MCI-MCO area, this can result is the aspiration process restarting and the VBI opening again. When the corresponding conductivity level is reached, the positioning of the sample is complete.

During the BG positioning ISE is separated between SS2 and SS1.

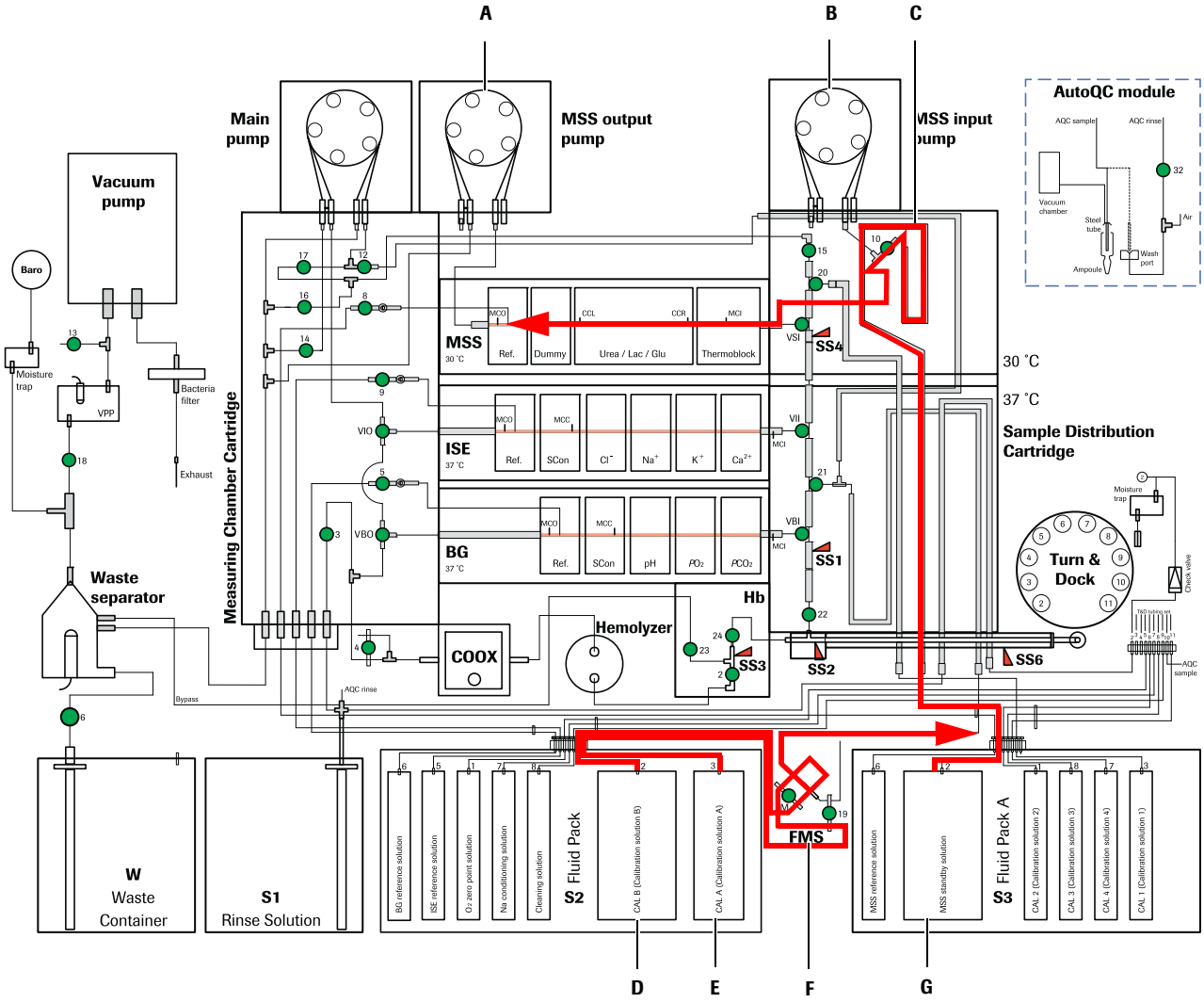
Positioning ISE: This aspiration process is similar to positioning BG. If an ISE measurement is not required, the remainder of the sample is aspirated to VII through the sample distributor to establish the required initial state for a subsequent MSS positioning.

Separating MSS and washing rail: A sample segment is aspirated to the SS4.

Positioning MSS: The sample is aspirated by turning the MSS output pump and opening the VSI. The tearing of the standby solution and the start of the sample is detected by the conductivity at the MSS input. Then it must also be possible to detect the tearing of the standby solution and the sample start, at which the MSS output pump is stopped. The completed sample positioning is checked again for freedom from bubbles via the conductivity distances.

Positioning tHb/SO_2 or COOX: The sample segment for measurement of tHb/SO_2 or COOX is positioned last. The valves V2, V4, V17 and V16 are opened and aspirated with the main pump. The sample is still hemolyzed in the event of a COOX measurement.

Aspirating MSS standby solution and starting FMS



A MSS output pump
B MSS input pump
C Aspirating MSS standby solution
D CAL B
E CAL A
F Starting FMS
G MSS standby solution

Figure A-13 Aspirating MSS standby solution and starting FMS

The MSS is positioned in four subsections:

Preconditioning by aspiration of standby solution (1)

This process is done before aspiration of the sample. A little reference solution is aspirated via V8 and the MSS reference electrode and is checked with the conductivity section at the MSS output.

For more information, see *Aspirating MSS reference solution, calibration with standby solution* on page A-39.

Then the measuring chamber is filled with standby solution.

Aspirate sample

The sample is aspirated by turning the MSS output pump and opening the VSI.

For more information, see *Sample distribution* on page A-23.

The tearing of the standby solution and the start of the sample is detected by the conductivity at the MSS input. Then it must also be possible to detect the tearing of the standby solution and the sample start, at which the MSS output pump is stopped. The completed sample positioning is checked again for freedom from bubbles via the conductivity distances.

Aspiration of standby solution (2) to determine glu and lac

The determination of the MSS measurement values is always based on the reference potential of the standby solution; for this reason the MSS cassette is filled with standby solution (by stopping the MSS input pump) after washing out the sample (with a mixture of standby solution and air by rotating the two MSS pumps). The quality of the aspiration is assessed by the conductivity distance at the MSS output.

The MSS input pump is used to fill the tube in the lateral channel (with standby solution), for defined aspiration (aspirating the standby solution) of the MSS measuring chamber cassette and for washing valve V10.

Aspiration of standby solution (3) to determine urea

The MSS cassette is filled with standby solution again. The quality of the aspiration and the stroke (after repeated aspiration of standby solution) is assessed by the conductivity distance at the MSS output.

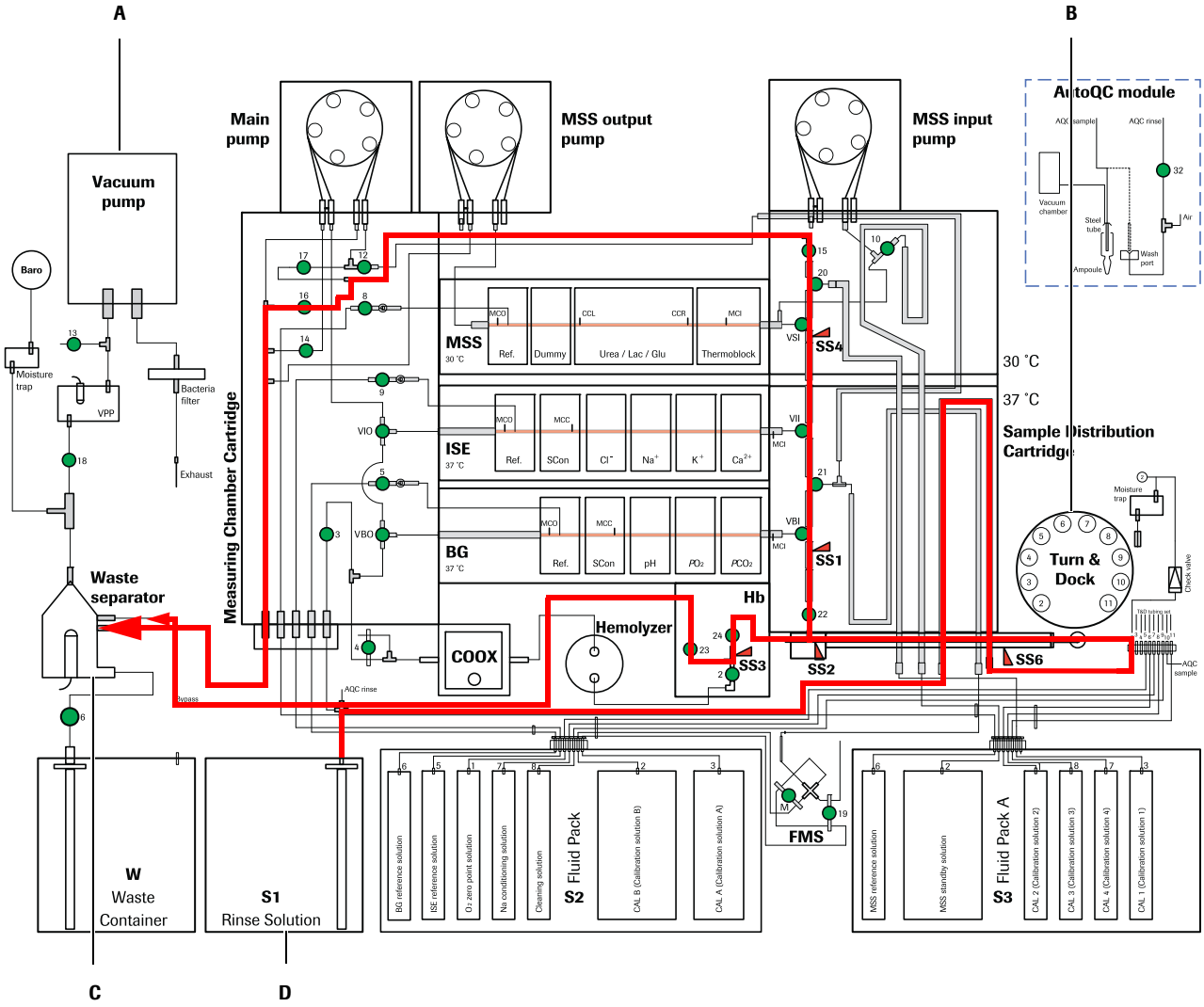
The sample segment for measurement of tHb/SO_2 or COOX is positioned last. The valves V2, V4, V17 and V16 are opened and aspirated with the main pump.

For more information, see *Sample distribution* on page A-23.

The sample is still hemolyzed in the event of a COOX measurement.

At the same time the FMS is started for these procedures (for the pending recalibration of the BG and ISE modules) and mixed from the A and B Mix1 solutions.

Washing the measuring chamber vicinity



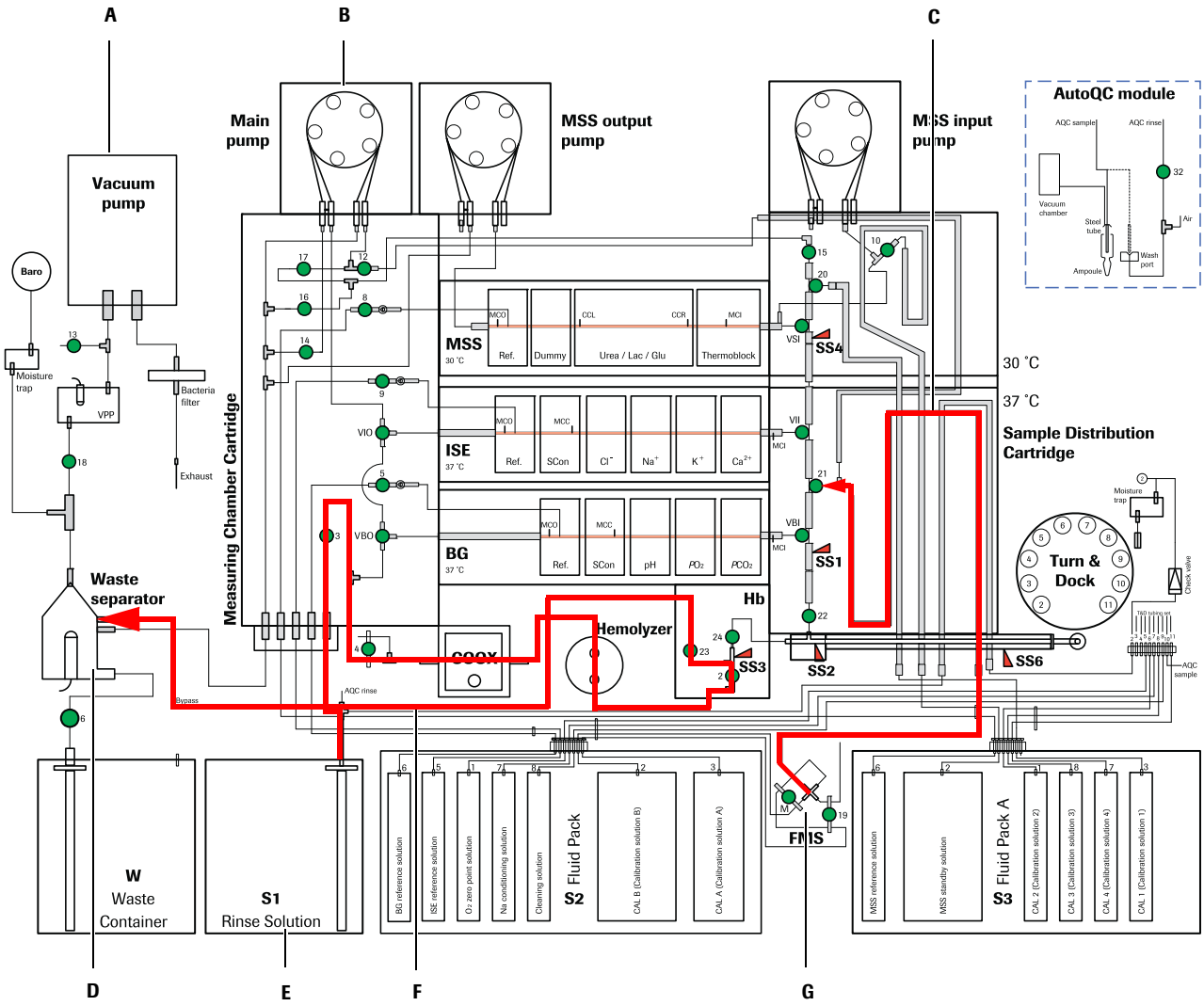
A Vacuum pump
B T&D module (position 2)
C Waste separator
D S1 Rinse solution

Figure A-14 Washing the measuring chamber vicinity

This section is used to clean sample residues from the aspiration path, the bypass and the sample distributor.

The T&D disk docks at position 2 (S1 Rinse solution); then a rinse solution-air mix is aspirated into the waste separator over the aspiration path and the bypass or the sample distributor (with V15 and V16 open) by creating a low pressure with the vacuum pump. The correct rinse solution to air ratio is assessed with the SS2 sensor.

Washing tHb/SO_2 or COOX and preparing Mix1



A Vacuum pump
B Main pump
C Preparing Mix1
D Waste separator
E S1 Rinse solution
F Washing tHb/SO_2 or COOX
G FMS

Figure A-15 Washing tHb/SO_2 or COOX and preparing Mix1

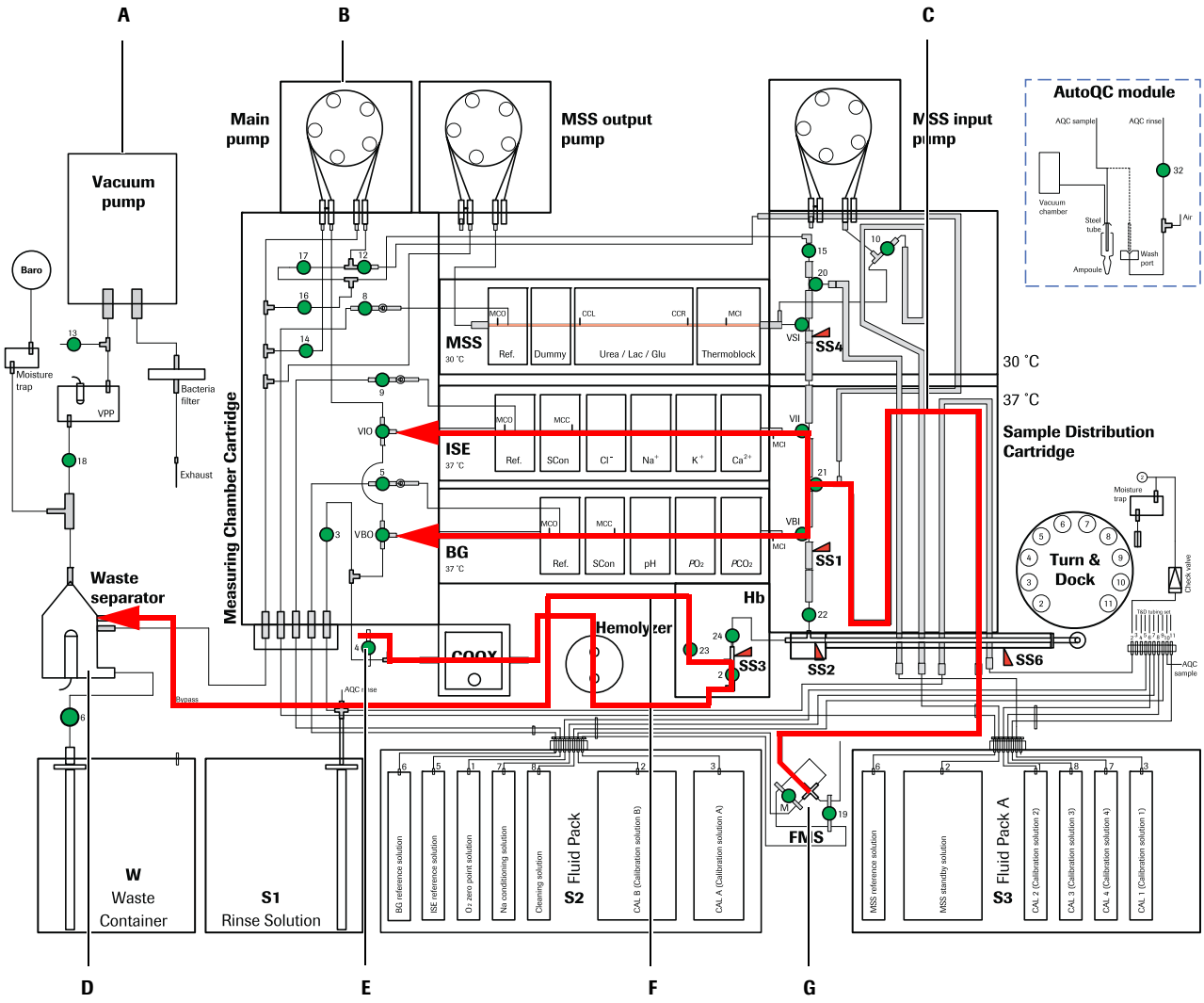
When the measuring chamber area is clean, the tHb/SO_2 or COOX module is washed. The vacuum pump runs rinse solution "in the reverse direction" from V3 through the measuring module to the Hb cartridge; air packets are mixed in through V4 to increase the cleaning effect.

Mix1 is aspirated from the FMS to the FMS tube simultaneously.

Then the measuring chamber area is dried. During this procedure the T&D disk is undocked with the vacuum pump running until the measuring chamber area is dry. The valve positions are the same as when washing the measuring chamber area.

For more information, see *Washing the measuring chamber vicinity* on page A-27.

Recalibrating BG/ISE and drying tHb/SO_2 or COOX



A Vacuum pump
B Main pump
C Recalibrating BG/ISE
D Waste separator
E V4
F Drying tHb/SO_2 or COOX
G FMS

Figure A-16 Recalibrating BG/ISE and drying tHb/SO_2 or COOX

To recalibrate BG and ISE the main pump first aspirates a mixture of air (from a reservoir between sample distributor and measuring chamber cartridge) and Mix1 through the measuring chambers. When this has sufficiently washed them, the measuring chambers are filled with Mix1 by shutting off the air feed.

This filling is assessed by conductivity measurement: with liquid solution a stable and plausible value must be measured between MCI and MCO.

Then the inlet valve is closed and reference solution is aspirated through valves V5 or V9 until a clear increase in conductivity between MCI and MCO can be detected.

For more information, see *Mix1/Mix2 calibration, aspirating BG/ISE reference solution* on page A-36.

Finally the outlet and reference valves are closed and the conductivity is checked again.

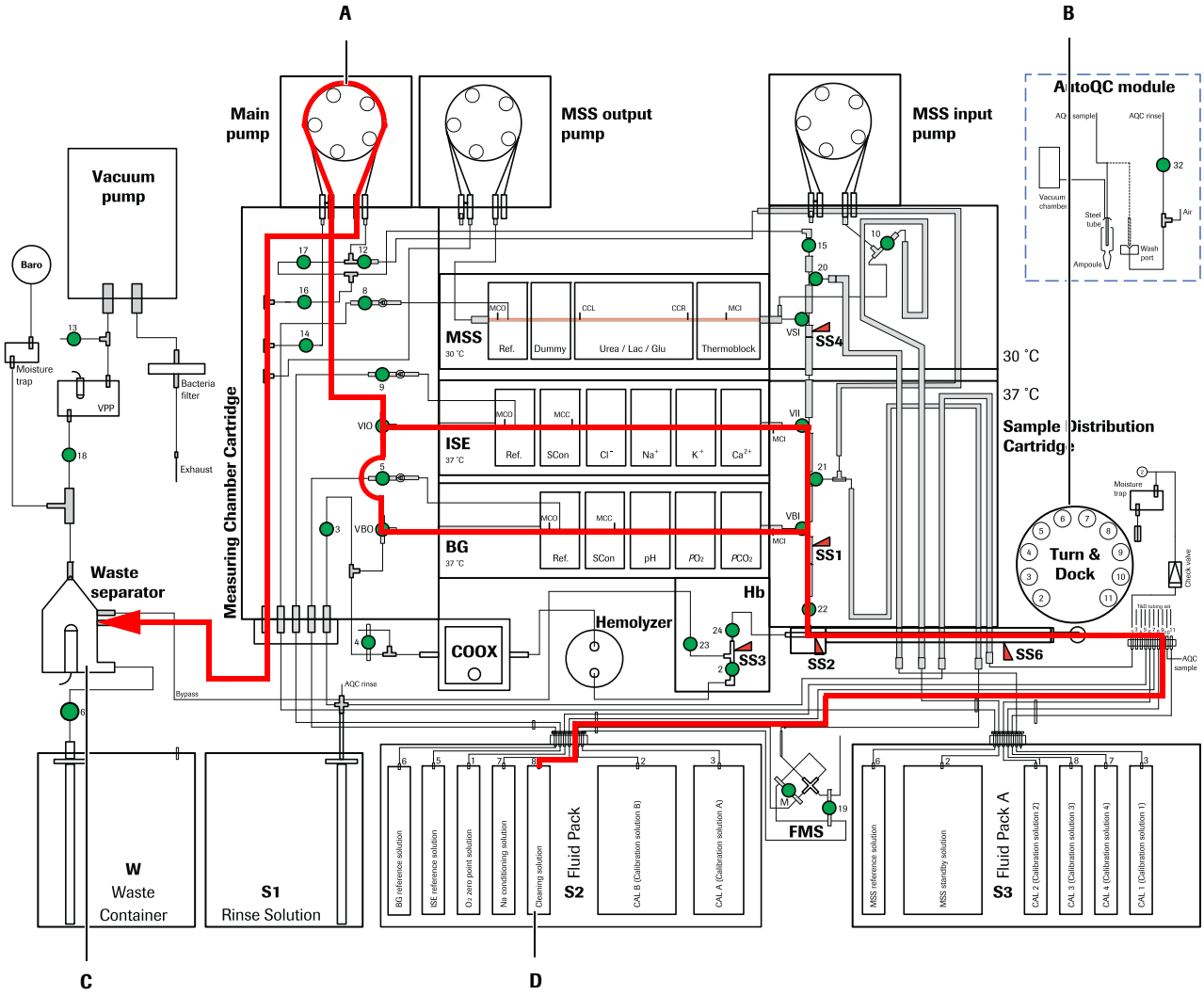
After each washing of the BG or ISE, the rail is washed and emptied to counteract electrical couplings to the pump elastomer.

Along with the recalibration the tHb/SO_2 or COOX module is dried. Air is aspirated into the waste separator with the vacuum pump through V4, measuring module, V2 and V23.

Before the instrument is released for the next measurement, Mix1 residue is aspirated into the waste separator with the main pump with valves V22, V15 open.

Calibration

BG/ISE cleaning



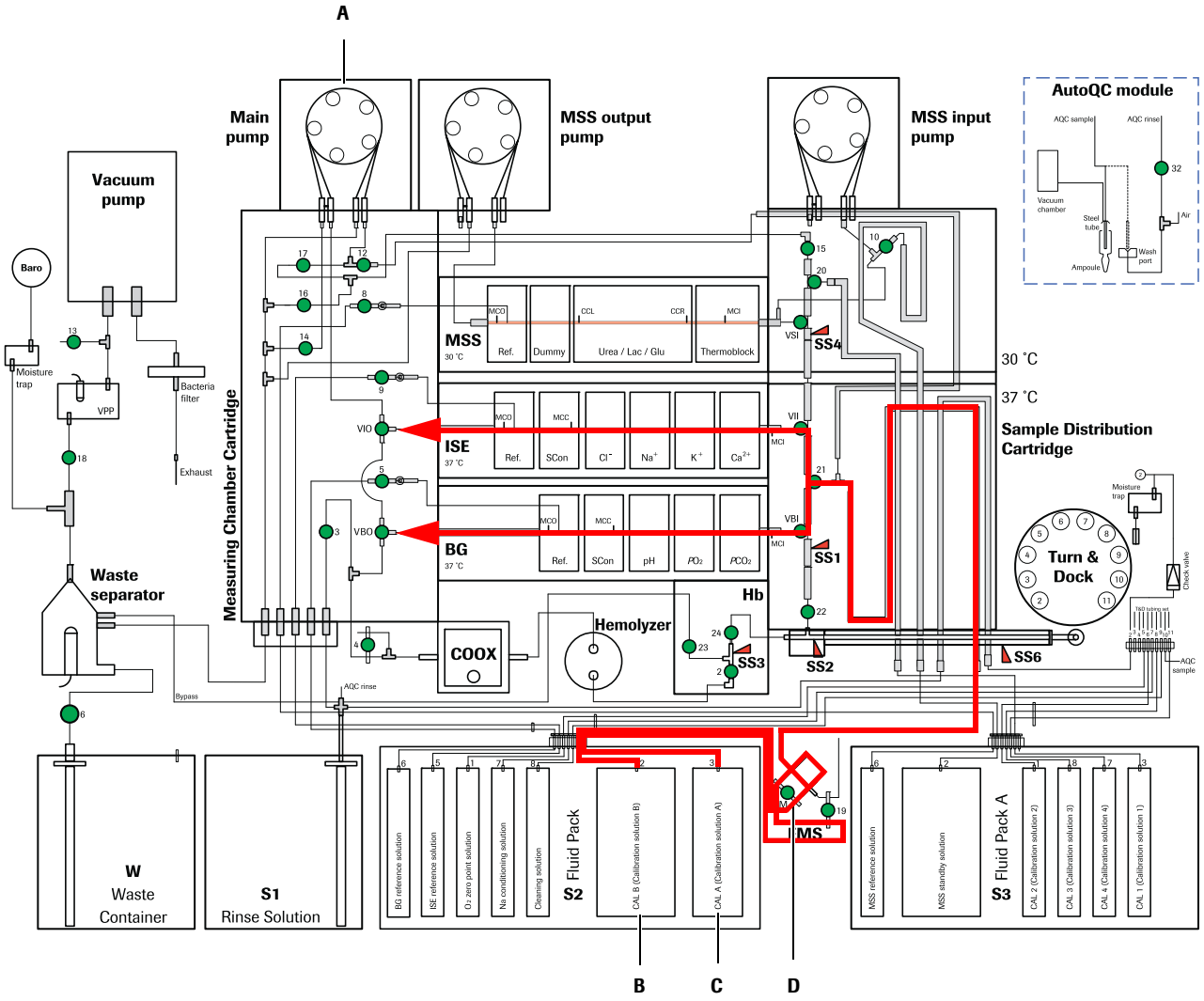
A Main pump
B T&D module (position 9)
C Waste separator
D Cleaning solution

Figure A-17 BG/ISE cleaning

This procedure removes deposits in the BG or ISE measuring chamber. The required cleaning solution is in the S2 Fluid Pack and is aspirated into the measuring chambers through the T&D disk (position 9), the aspiration channel and the sample distributor.

The calibration of the conductivity is performed next.

Calibrating the conductivity for CAL A or CAL B



A Main pump
B CAL B
C CAL A
D FMS

Figure A-18 Calibrating the conductivity for CAL A or CAL B

FMS adjustment: This procedure starts by aspirating the FMS through V19 (air) until it is empty. After a short pressure equalization V19 is closed and CAL B is aspirated into the BG measuring chamber (👁 Figure A-18).

CAL B must be detected in the BG measuring chamber by the conductivity measuring distance within a set period (after 9.64 sec at the earliest and after 12.34 sec at the latest).

Calibrating the conductivity for CAL B

In this section the conductivity of calibration solution CAL B is precisely measured in the BG and ISE measuring chamber. The precision of this measurement is very significant for Mix1 and Mix2, because they are based on this measurement.

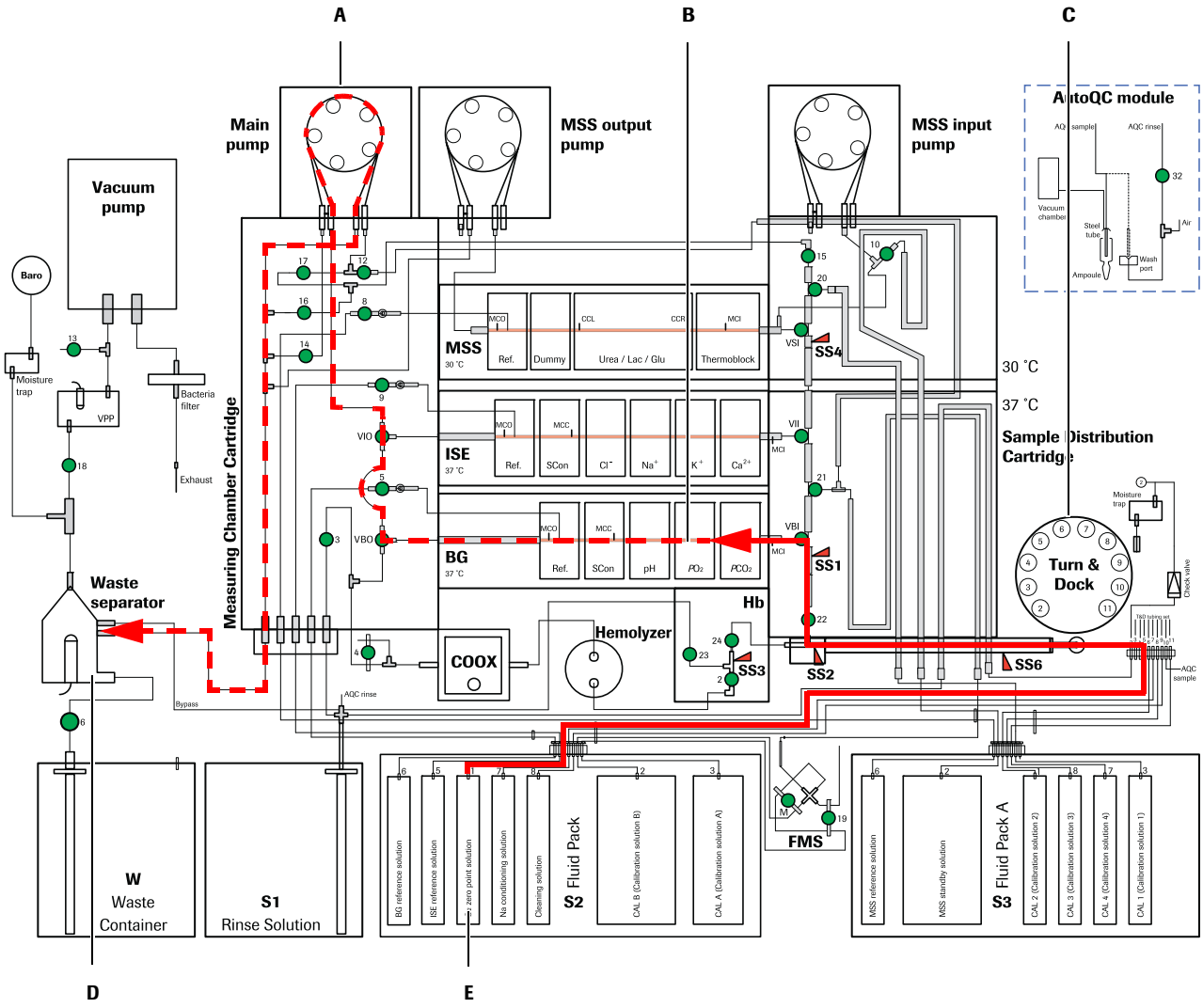
CAL B is already in the sample distributor at V21. The BG measuring chamber is cleaned with a mixture of air and CAL B after the FMS adjustment. Then the BG measuring chamber is filled with CAL B with no air bubbles and the conductivity is determined.

Then CAL B is aspirated into the ISE measuring chamber and also measured there.

Calibrating the conductivity for CAL A

This procedure is similar to the calibration of the conductivity for CAL B, with the only difference being that a FMS adjustment is not made first.

O_2 zero point calibration



A Main pump
B O_2 electrode
C T&D module (position 5)
D Waste separator
E O_2 zero point solution

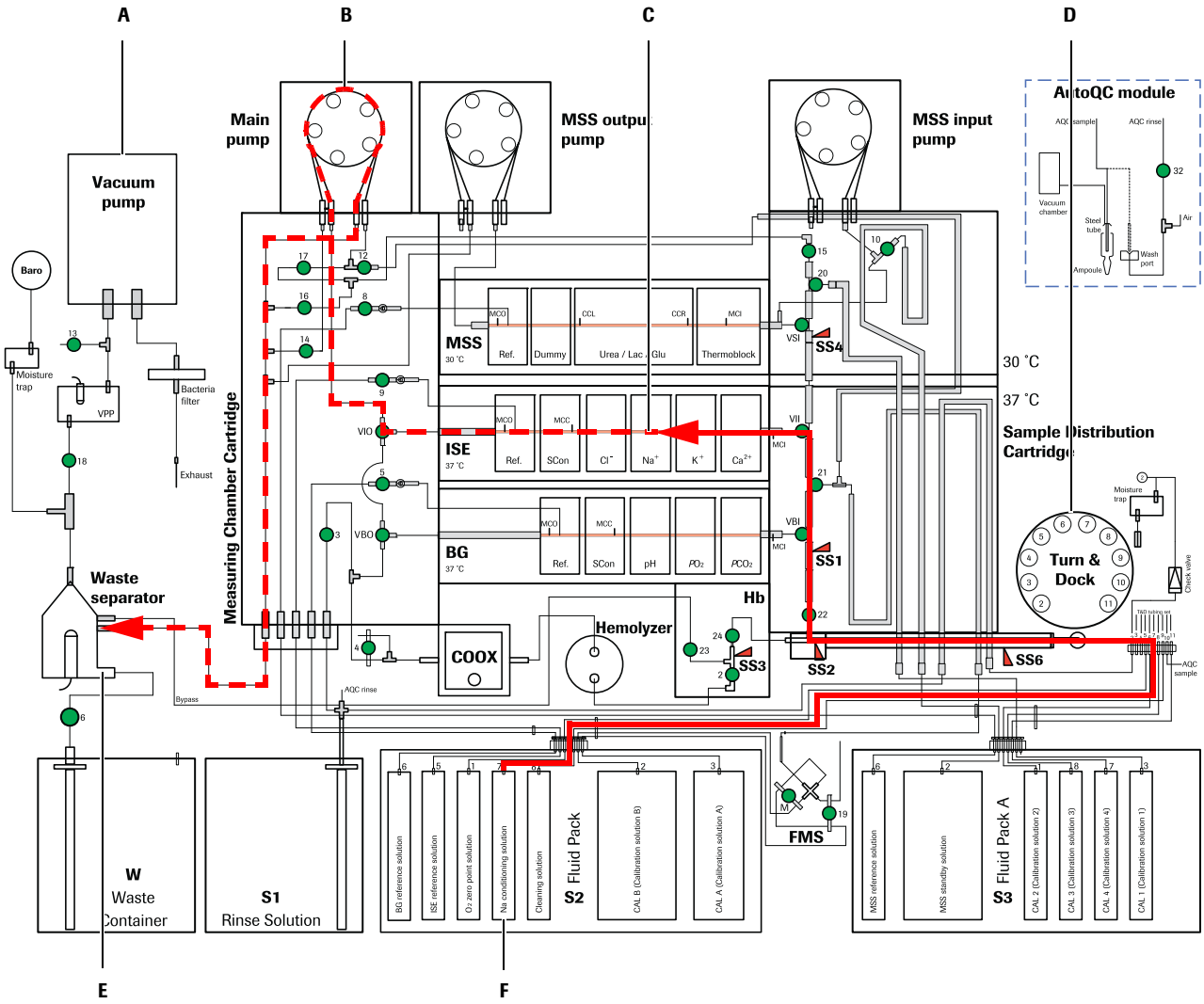
Figure A-19 O_2 zero point calibration

This procedure determines the second calibration point of the O_2 electrode. The O_2 zero point solution is in the S2 Fluid Pack and is aspirated into the BG measuring chamber with the vacuum pump and the main pump through the T&D disk (position 5) and the aspiration channel through SS2 and SS1.

After completing this procedure the measuring chamber area is briefly washed.

For more information, see *Washing the measuring chamber vicinity* on page A-27.

Na conditioning



A Vacuum pump
B Main pump
C Na electrode
D T&D module (position 7)
E Waste separator
F Na conditioner

Figure A-20 Na conditioning

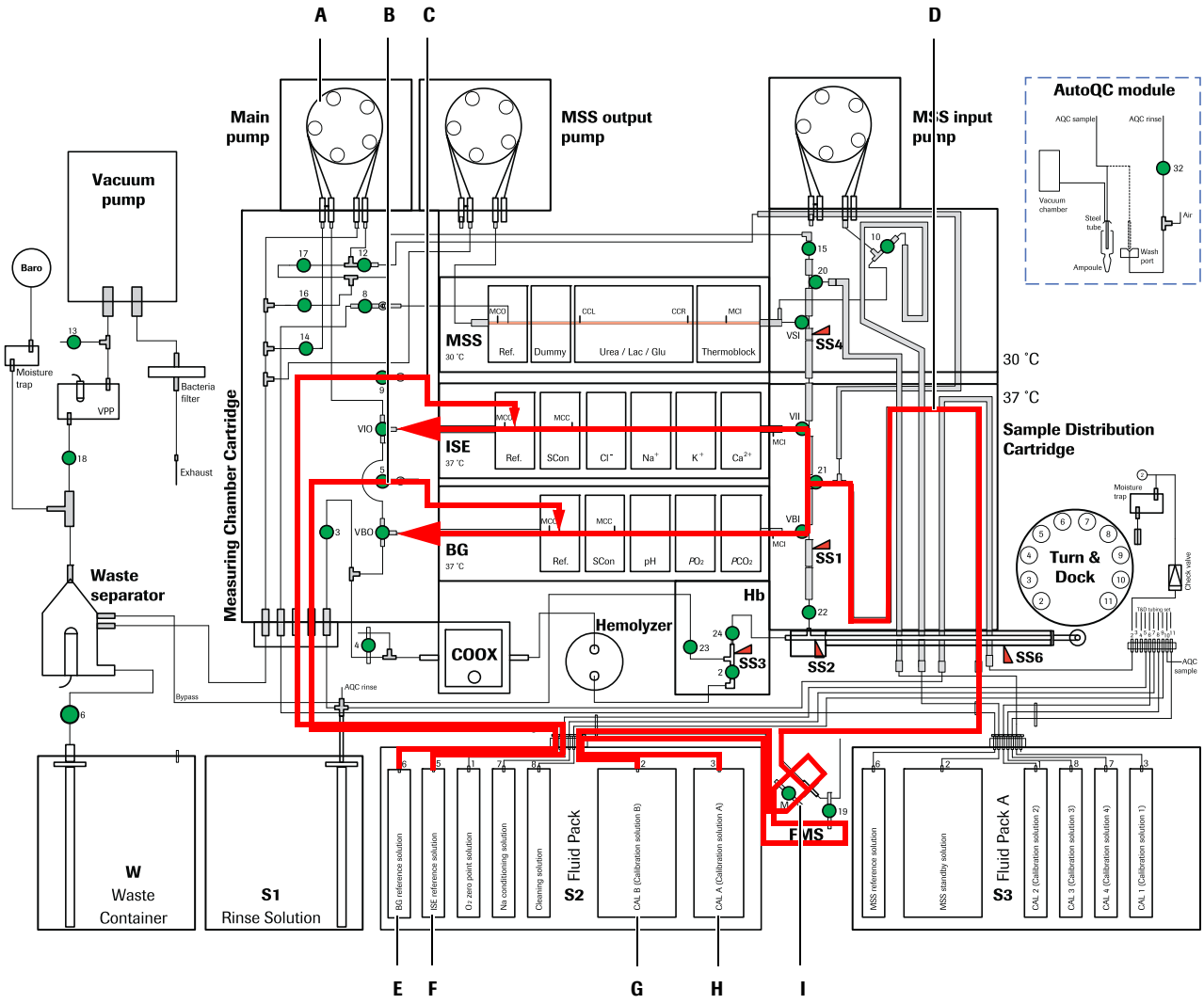
This procedure is necessary to retain the sensitivity of the Na electrode. The Na conditioner is in the S2 Fluid Pack and is aspirated into the ISE measuring chamber with the vacuum pump and the main pump through the T&D disk (position 7) and the sample inlet path through SS2 and SS1.

After this procedure the measuring chamber area is washed, and the tHb/SO_2 or COOX module is also washed and Mix1 is prepared.

For more information, see:
Washing the measuring chamber vicinity on page A-27
Washing tHb/SO_2 or COOX and preparing Mix1 on page A-28

In the case of the tHb/SO_2 module a calibration is conducted during the washing procedure by measuring the rinse solution values.

Mix1/Mix2 calibration, aspirating BG/ISE reference solution



A Main pump
B Aspirating BG reference solution
C Aspirating ISE reference solution
D Mix1/Mix2 Calibration
E BG Reference solution
F ISE Reference solution
G CAL B
H CAL A
I FMS

Figure A-21 Mix1/Mix2 calibration, aspirating BG/ISE reference solution

Mix1 Calibration

This section refers to the BG and ISE measuring chamber only. The Mix1 mixture is prepared similarly to a recalibration in the sample distributor after a measurement and is ready for entry to the measuring chamber at V21.

For more information, see *Recalibrating BG/ISE and drying tHb/SO_2 or COOX* on page A-29.

The main pump first aspirates a mixture of air (from a reservoir between sample distributor and measuring chamber cartridge) and Mix1 through the measuring chambers. When this has sufficiently washed them, the measuring chambers are filled with Mix1 by shutting off the air feed.

This filling is assessed by conductivity measurement: with liquid solution a stable and plausible value must be measured between MCI and MCO.

Then the inlet valves are closed and reference solution is aspirated through valves V5 or V9 until a clear increase in conductivity between MCI and MCO can be detected. Finally the outlet and reference valves are closed and the conductivity is checked again.

Mix2 Calibration

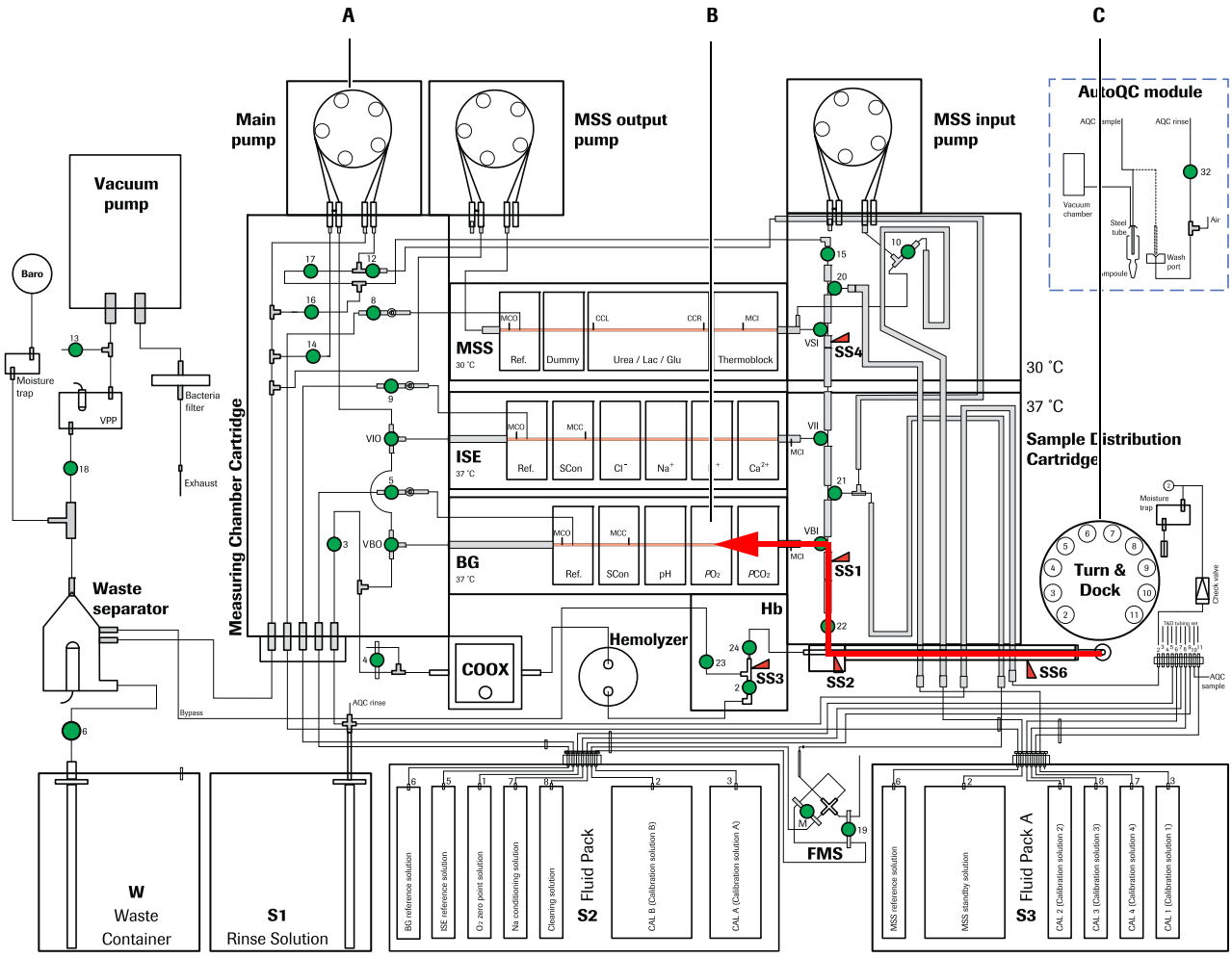
The fluid procedure corresponds exactly to the Mix1 calibration.

The only difference is the mixture ratio of CAL A and CAL B:

Mix1:	33.3% CAL A
	66.6% CAL B
Mix2:	60.0% CAL A
	40.0% CAL B

The Mix2 calibration determines the slopes of the BG electrodes CO_2 and pH along with all ISE electrodes.

O_2-air calibration



A Main pump

B O_2 electrode

C T&D module (position 4)

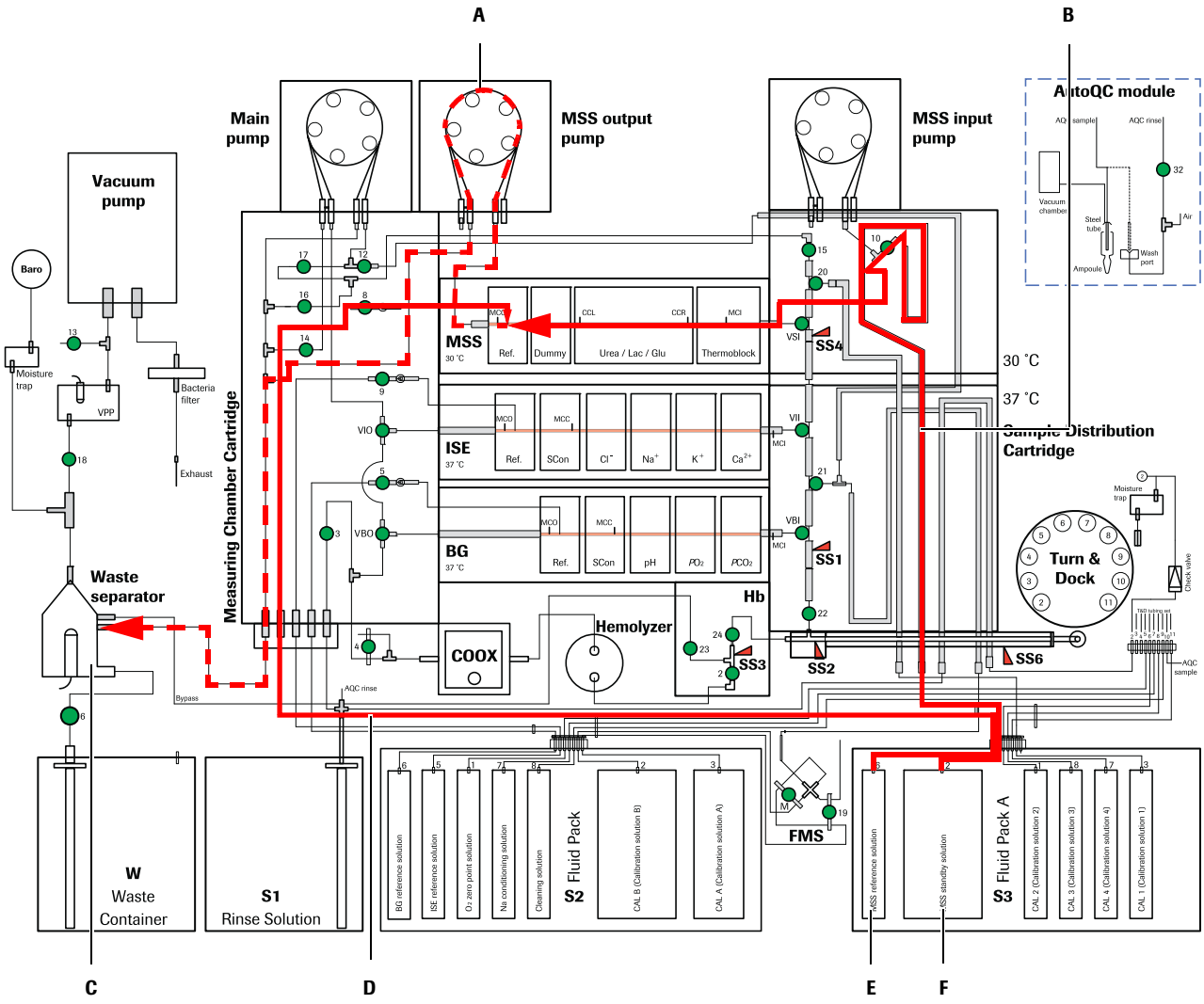
Figure A-22 O_2-air calibration

This procedure determines the first calibration point of the O_2 electrode. Ambient air is slowly aspirated from the T&D disk (position 4) into the BG measuring chamber over the aspiration channel and sample distributor.

Then the electrodes are conditioned with Mix1.

For more information, see *Mix1/Mix2 calibration, aspirating BG/ISE reference solution* on page A-36.

Aspirating MSS reference solution, calibration with standby solution



A MSS output pump

B Calibration with standby solution

C Waste separator

D Aspirating MSS reference solution

E MSS Reference solution

F MSS Standby solution

Figure A-23 Aspirating MSS reference solution, calibration with standby solution

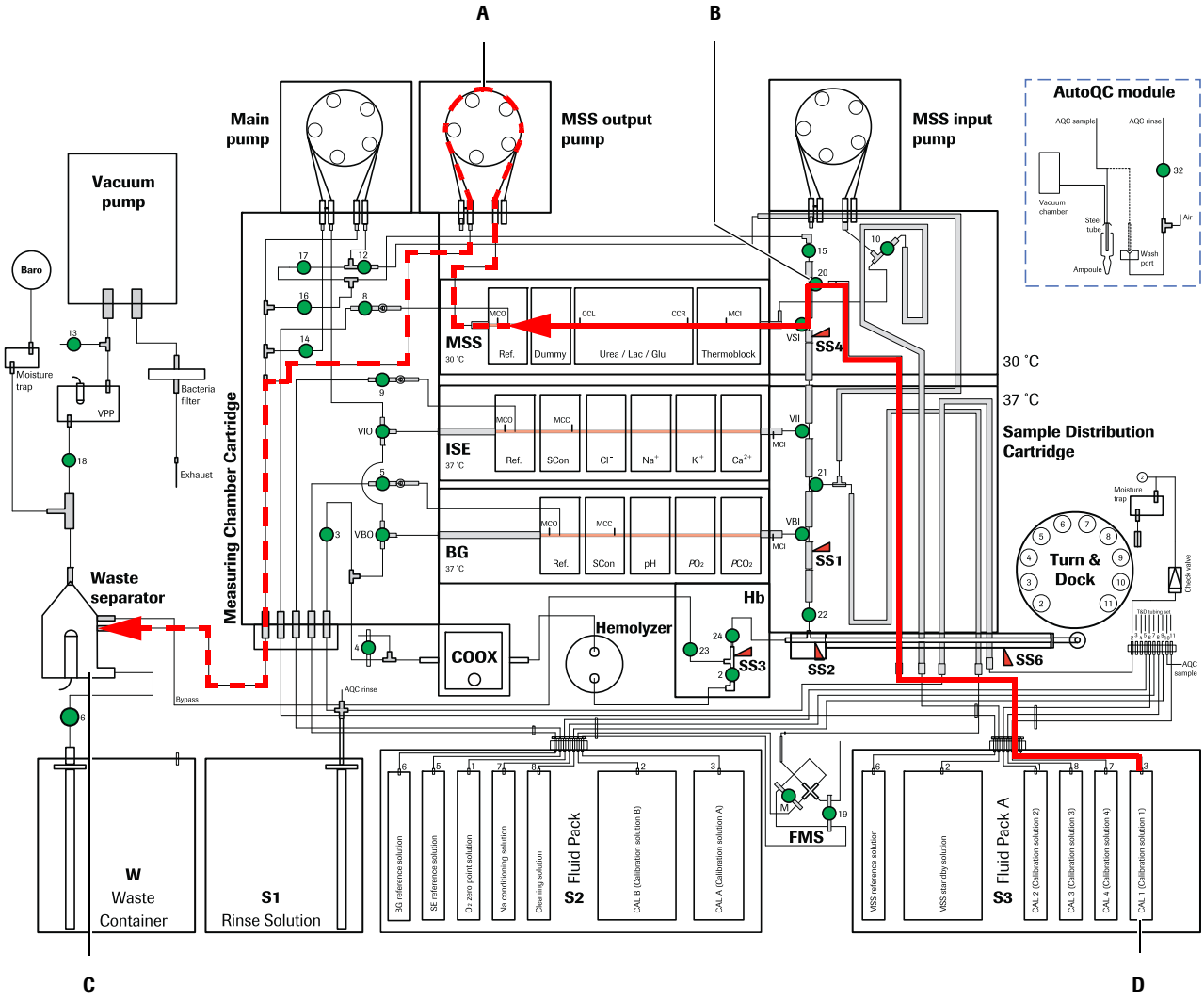
The MSS cassette is calibrated in the following sequence:

First a MSS standby solution packet is positioned through a metal pipe in the sample distributor and valves V10 and VSI into the MSS measuring chamber which is called "Ref. point D1". Following this one of the calibration solutions (CAL 1, CAL 2, CAL 3 or CAL 4) is aspirated and positioned into the MSS measuring chamber. After this another MSS standby solution packet is positioned into the MSS measuring chamber which is called "D2" and last followed by a third MSS standby solution packet called "D3".

For instruments with Urea installed only: The reference measurement for urea is done by aspirating reference solution after positioning the "D1" and the "D2" packets.

For more information, see:
CAL 1 Calibration on page A-41
CAL 2/CAL 3/CAL 4 Calibration on page A-42

CAL 1 Calibration

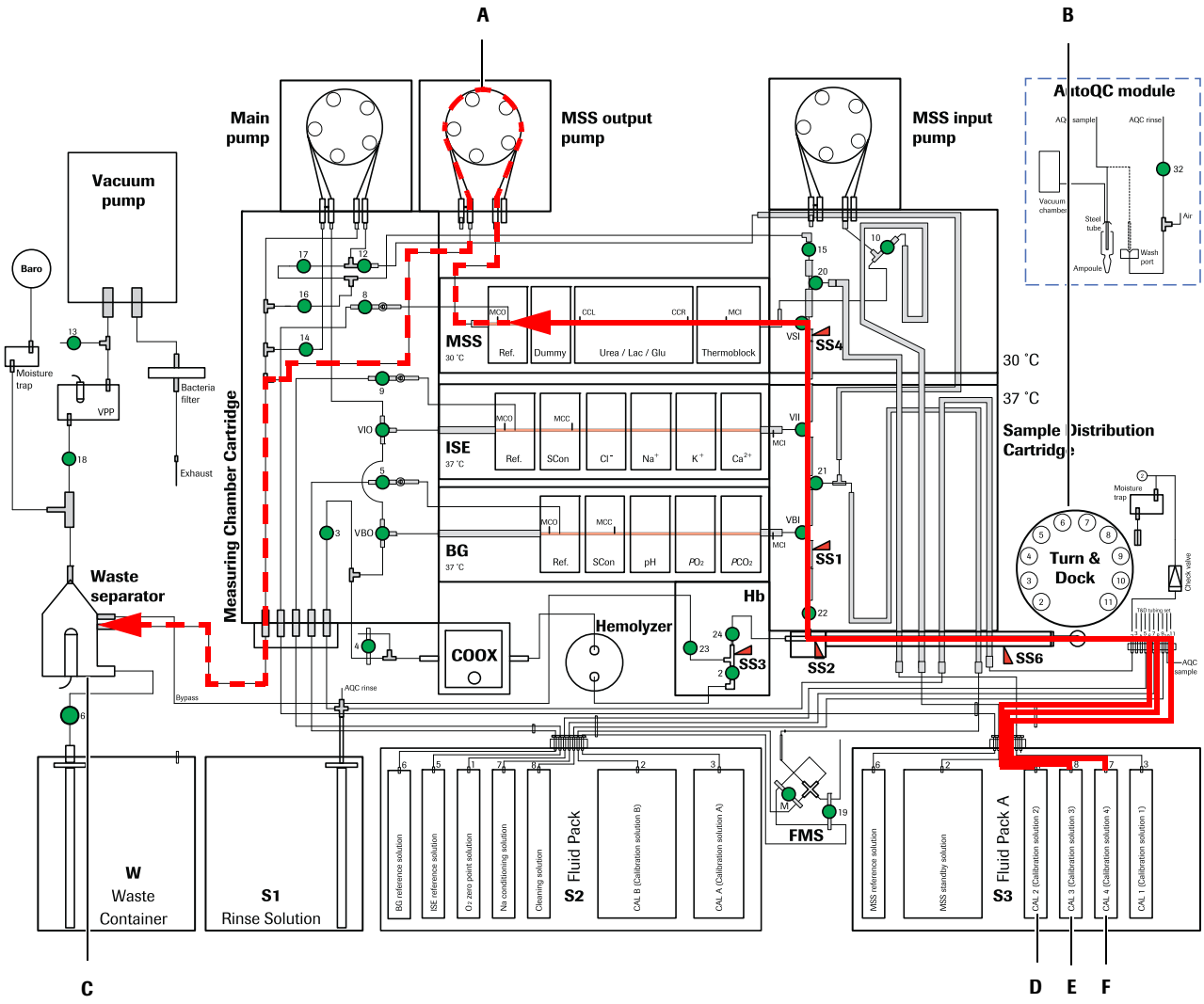


A MSS output pump
B V20
C Waste separator
D Calibration solution CAL 1

Figure A-24

This procedure determines the sensitivity of the sensors. CAL 1 is aspirated into the MSS measuring chamber from the S3 Fluid Pack A through a metal pipe in the sample distributor and valves V20 and VSI and measured. The positioning is checked by conductivity measurements.

CAL 2/CAL 3/CAL 4 Calibration



A MSS output pump
B T&D module (CAL 2=Pos.6, CAL 3=Pos.8, CAL 4= Pos.11)
C Waste separator
D CAL 2
E CAL 3
F CAL 4

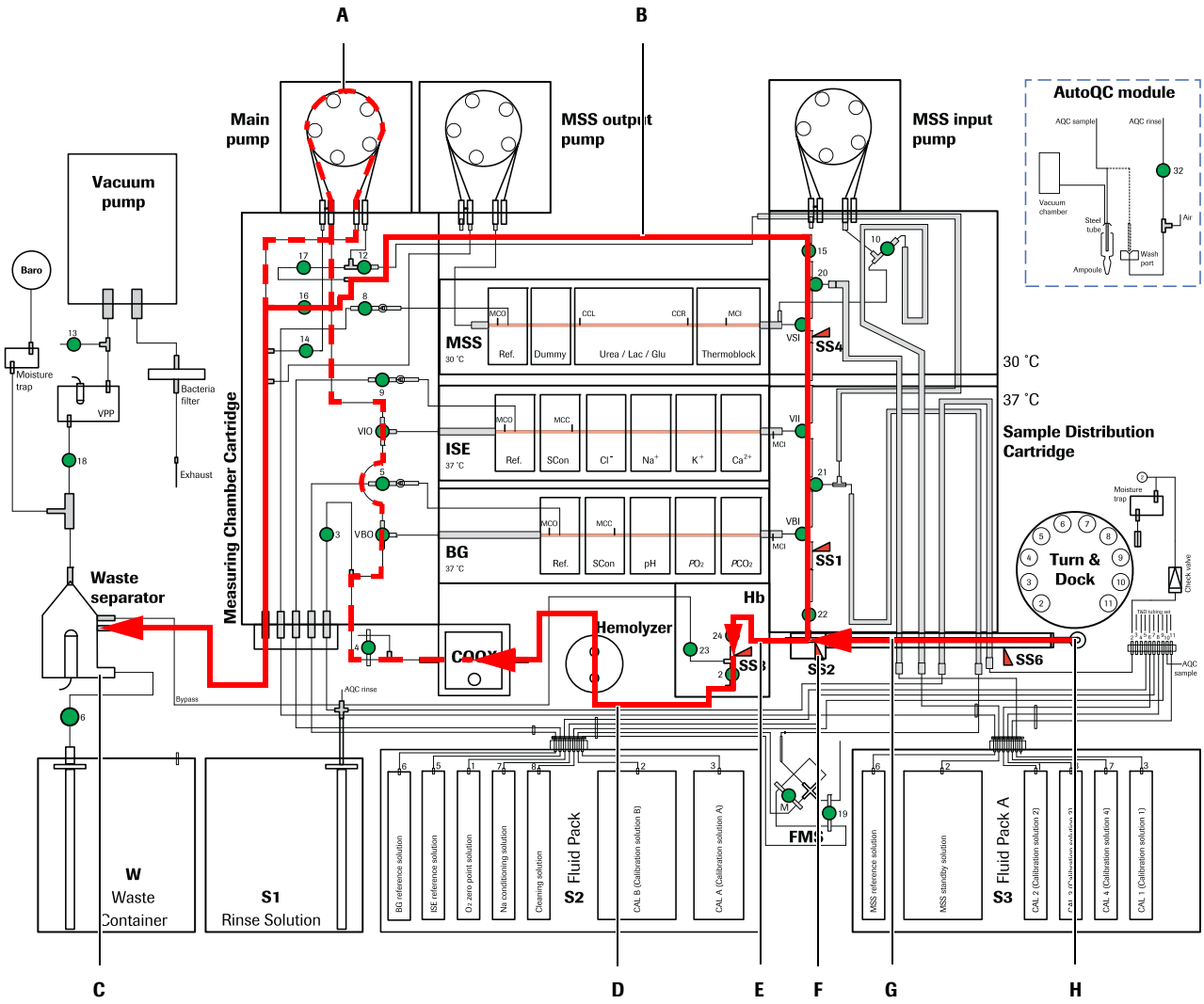
Figure A-25 CAL 2/CAL 3/CAL 4 Calibration

CAL 2 Calibration This procedure determines the linearity of the sensors. CAL 2 is aspirated from the S3 Fluid Pack A via the T&D disk (position 6), sample inlet path and sample distributor into the MSS measuring chamber and measured.

CAL 3 Calibration This procedure determines the interference sensitivity of the sensors. CAL 3 is aspirated from the S3 Fluid Pack A via the T&D disk (position 8), sample inlet path and sample distributor into the MSS measuring chamber and measured.

CAL 4 Calibration This procedure determines the interference sensitivity of the sensors. CAL 4 is aspirated from the S3 Fluid Pack A via the T&D disk (position 11), sample inlet path and sample distributor into the MSS measuring chamber and measured.

COOX calibration



A Main pump
B Aspirate excess out
C Waste separator
D Position calibrator
E Separator COOX
F SS2
G Calibrator input
H Fill port

Figure A-26 COOX calibration

The calibration does not begin automatically but must be initiated by the user. The fill port of the T&D module is released for input from an external tHb calibrator.

Once the SS2 sensor has detected the solution and the sample container has been removed, the positioning begins: a separation at the SS3 sensor is made, then the excess solution is aspirated out through the sample distributor. The calibration solution is now aspirated through V2 and the hemolyzer through the cuvette with the main pump. The optical measurement and storage of the cuvette layer thickness is made here.

Finally the COOX module is washed and dried.

For more information, see:
Washing tHb/SO_2 or COOX and preparing Mix1 on page A-28
Recalibrating BG/ISE and drying tHb/SO_2 or COOX on page A-29

Servicing B

3 Protected software functions B-3

4 Components B-15

5 AutoQC module B-117

Protected software functions

This chapter provides information about the protected software functions of the **cobas b** 221 system.

In this chapter *Chapter* 3

Protected setup 5
Sample counter 5
Baro settings 5
Miscellaneous settings 6
Serial number 6
Instrument type 6
Polarization voltages 10
COOX module (**cobas b** 221<2/4/6> systems only) 10
AutoQC module 10
Log monitor 11
Protected system functions 11
System backup / restore 11
AQC adjustment 12
Protected infos 12
Service log file export 12
Protected DB functions 13
Delete all databases 13
Delete databases & archives 13

Protected setup

Sample counter

This function allows manual editing of the internal sample counter. See *Samples* for the sum of all samples input (can be edited by the keyboard symbol), *QC samples* for the number of QC samples input (can be edited by the keyboard symbol) and *Measurements* for the number of measurements made (can be edited by the keyboard symbol).

Baro settings

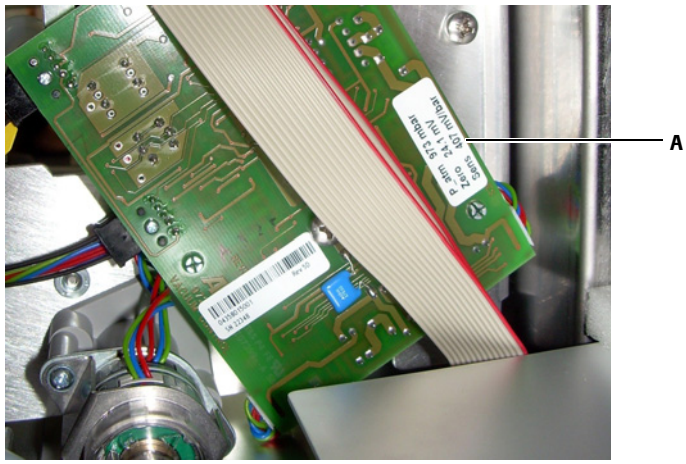
This function allows various barometer settings to be manually edited.

The following options are available:

P_atm, SENS, ZERO In case of errors read the factory settings from the label on the vacuum control board and type them in here. See Figure B-1 on page B-5.

Baro [mmHg] input the baro value with the keyboard symbol.

[Update EEPROM] this key allows the data of the vacuum EEPROM to be updated by the **cobas b** 221 system software. The data on the hard disk are written to the EEPROM.



A Label

Figure B-1 Baro settings, factory settings (label)

P_atm, SENS and ZERO are default settings which may only be changed in case of errors according to the values on the label!

IMPORTANT:

- *From approx. 3000 m above sea level or air pressure < 526 mmHg (70.13 kPa), the specifications for parameter PO_2 are no longer fulfilled and the parameter must no longer be used for evaluation of the clinical decisions.*
- *After successful installation, the parameter must be permanently deactivated!*

Miscellaneous settings

This function is used to activate various auxiliary programs and service actions.

The following options are available:

[Demo mode] This function simulates the **cobas b** 221 system with all measurement values for demonstration purposes. The measurement values are not calibrated; instead they are spread around a mean value.

[Logon with Operator ID] This function allows a user to logon to the instrument by entering the operator ID only (without password).

[Measurement report operator ID] With deactivated function no operator ID will be printed on the measurement report.

[Cal. intervals U.S.] This key reduces the 2P calibration interval of PO_2 from 72 hours to the 2P calibration interval of the other parameters to correspond to specific legal requirements in the USA.

[Bili] This key activates (green) or deactivates (red) the parameter bilirubin (**cobas b** 221<2/4/6> systems only). If activated, bilirubin will be ready for measurement after a calibration.

[Service mode] This key activates an external keyboard connected to the **cobas b** 221 system.

[Hotline info] This key edits the information hotline (that appears under Customer Information).

*[**cobas b** 221 auto.]* This key will switch instruments with serial number ≥ 5000 to **cobas b** 221 system.

*[**cobas b** 221 Roche OMNI S]* This key switches the instrument to Roche OMNI S or to the **cobas b** 221 system.

Serial number

This function assigns a serial number after pressing the keyboard symbol. Be sure the serial number is the same as the serial number on the name plate on the rear panel of the instrument.

Instrument type

Changing instrument type

This function is used to define the instrument type that is valid for the respective instrument. Marking the desired instrument types and pressing the key [Save and exit] assigns the new type to the **cobas b** 221 system software.

The key [Load default setup] resets any changes made to the instrument type and loads the default settings of the instrument stored on the hard disk.

Load the allowed default setup

It is only allowed to load the default setup according to the available module configuration.

Instrument	Setup	Configuration
cobas b 221<1> system	10	BG + tHb
cobas b 221<2> system	20	BG + COOX
cobas b 221<3> system	30	BG + ISE + tHb
cobas b 221<4> system	40	BG + ISE + COOX
cobas b 221<5> system	50	BG + ISE + tHb + Glu/Lac
cobas b 221<6> system	60	BG + ISE + COOX + Glu/Lac
	61	BG + ISE + COOX + Glu/Lac/Urea

Table B-1 Instrument configurations

For details, see *Fluid actions overview* on page A-13.

After replacing the touch screen/PC unit or the hard disk, assign the valid instrument type and load the default settings. When system stop 10005 occurs after replacing the touch screen/PC unit or the hard disk and booting the PC, assign the valid instrument type and load the default settings.

Load default setup

Following default settings will be loaded depending on the instrument type:

Setting	Default	Comment
1P cal. interval	60 min	
2P cal. interval	12 hours	
System calibration interval	24 hours	
System calibration start time	05:00	
Full backup: Start day	Sunday	
Full backup: Start time	00:00	
Incemental backup: Start time	00:00	
DB export: compression	OFF	
DB export: separator	1;2	
DB export: file name	export	
DB export: decimal point	12.34	
Print sensor report	OFF	
Print parameter report	ON	
Print measurement report	ON	
Auto. cut	OFF	
Density	4	
ASTM host	------	
ASTM port	------	
Enable ASTM	OFF	
Transmit log data	OFF	
Economy mode:	OFF	
Economy mode: daily: start time	18:00	
Economy mode: daily: stop time	05:00	
Economy mode: weekly	OFF	

Table B-2 Default settings

Setting	Default	Comment
Economy mode: weekly: start day	Friday	
Economy mode: weekly: start time	18:00	
Economy mode: weekly: stop day	Moday	
Economy mode: weekly: stop time	05:00	
Aspirate from syringe	ON	
Auto patient ID	OFF	
Auto save results	ON	
Apply corrections	ON	
Supress negative values	ON	
Display – message box	30 sec	
Switch to measurement report	10 sec	
Display – measurement report	10 sec	
Automatic menu back	3600 sec	
Remove sample cont. warning 1	10 sec	
Remove sample cont. warning 2	20 sec	
Log off user	900 sec	
Sound	ON	
Volume	3	
Cal. intervals U.S.	OFF	
SW upgrade: Server	0.0.0.0	
SW upgrade: Path	-----	
SW upgrade: User	anonymous	
SW upgrade: Password	0	
Language	German	
Date format	TT.M.JJJJ	
Time format	HH:MM	
Log monitor prinout	OFF	
Log file generations	5	
Log file entries	30000	
Module priority	BG-COOX-ISE-MSS	
Activated for calibrations	ON	for all measurement parameters
Activated for measurements	ON	for all measurement parameters
QC lock	ON	for all measurement parameters
QC warning	OFF	for all measurement parameters
activated Multirules	rule 1 and rule 2	for all measurement parameters
AutoQC timing	all times deleted	

Table B-2 Default settings

Setting	Default	Comment
AutoQC mat assignment	all settings deleted	
Service mode	OFF	
PC Demo mode	OFF	

Table B-2 Default settings

Default maintenance schedule:

Maintenance	Remind.	Interval	Samples
BG cleaning	No	Never	500
ISE cleaning	No	Never	200
MSS cleaning	No	Never	---
COOX cleaning	No	Never	20
tHb cleaning	No	Never	20
Change SD cartridge	No	1095 days	---
Change MC cartridge	No	1095 days	---
Change Hb cartridge	No	1095 days	---
Change main pump tubing	No	365 days	---
Change MSS output pump tubing	No	365 days	---
Change MSS input pump tubing	No	365 days	---
Change FMS tubing	No	365 days	---
Change V6, V13, V18 tubing	No	365 days	---
Change fill port	No	365 days	---
Change T&D tubing	No	365 days	---
Change AQC steel tube	No	365 days	---
Change AQC barex tube	No	365 days	---
Change AQC wash port	No	365 days	---

Table B-3 Default maintenance schedule

Unmodified settings:

- User management
- Profile management
- Measurement reports
- Instrument type
- Network settings
- QC material setup and QC timing
- Sample counter
- COOX adjustments
- Serial number
- AQC module
- AQC temperature correction
- Bili
- Units

Polarization voltages

Upol O_2

The keyboard symbol under *Upol O_2* can be used to change the polarization voltage of the oxygen electrode (default value 750 mV). The [Adjust] key is used to confirm and import the newly defined value.

Upol MSS (cobas b 221<5/6> systems only)

The keyboard symbol under *Upol MSS* can be used to change the polarization voltage of the MSS sensors (default value -350 mV). The [Adjust] key is used to confirm and import the newly defined value. The polarization voltage can only be changed with the MSS cassette inserted.

COOX module (cobas b 221<2/4/6> systems only)

Setup

The number of samples during a measurement is shown under *Scans* (1, 2, 4, 8 and 16 samples are possible).

The duration of sampling during a measurement is shown under *Integration time* (12 ms to 12000 ms are possible).

COOX switches

This setting is intended for internal purposes only and must be changed only when specifically directed!

The [Suppress negative values] key activates (green) or deactivates (red) the suppression of the output of negative values during a measurement. The measurement values are set to 0 in the event of activation and a matching tHb compensation is made.

COOX adjustments

The offset values for the polychromator bilirubin are stored here. After replacing the polychromator bilirubin, the touch screen/PC unit or the hard disk, they must be re-entered by means of entering the code. The code is located on the polychromator and must be entered using the keyboard symbol under *Set*.

The [Set default value] key loads the default settings of the polychromator bilirubin stored on the harddisk.

AutoQC module

The [Temperature correction] key activates (green) or deactivates (red) the temperature correction of the pH, PO_2 and PCO_2 measurement values during a QC measurement to receive standardized measurement results.

Log monitor

The [Log monitor printout] key activates (green) or deactivates (red) the output of all log monitor data at the internal thermal printer.

The keyboard symbol can also be used to specify the number of generations and the number of log file entries in the printout.

Deactivate this function to prevent permanent stress on the thermal printer!

Protected system functions

System backup / restore

This function allows to backup all instrument related data to USB mass storage. It is intended to be used when replacing the hard disk, replacing the touch screen/PC unit or for a full backup.

Important system backup information

The data from the system backup may only be imported on the same instrument on which the backup was created. If this is not considered this may lead to incorrect patient measurements, which may result in incorrect clinical decisions, possibly endangering the patient's health.

USB mass storage required

This function uses USB mass storage.

For detailed requirements, see *USB troubleshooting* on page D-91.

► Starting the system backup

1 At the ready screen, press ☞ [System] > [Protected functions] > [System backup / restore].

2 Press ☞ [Save system data].

The system data are being prepared and the instrument software will be restarted.

3 After restart of the software, press ☞ [Save system data on USB device].

The system data will be saved into the folder "Roche\data\". This process may take several minutes.

After replacing the hard disk, replacing the thouch screen/PC unit or to restore the backup do the following.

► Restoring the system backup

1 At the ready screen, press ☞ [System] > [Protected functions] > [System backup / restore].

2 Press ☞ [Load system data from USB device].

3 Press ☞ [Activate system data].

The instrument software will be restarted and the restored system data is available.

AQC adjustment

The start [Start] key initializes a position compensation of the AutoQC motors to ensure that ampoules are pierced at the correct position after replacement of the AutoQC board. This should be performed in the course of AQC maintenance.

To avoid damage, the AQC ampoule mats must be removed from the AQC ampoule block before starting the adjustment!

Be aware of possible injuries due to moving parts!

Protected infos

USB functionality

When USB mass storage devices (USB flash drives) are connected to the instrument export and import will use USB instead of floppy disk. Export to and import from USB mass storage requires software version 5.00 or higher to be installed on instruments using touch screen/PC units version 4.X or higher and interface unit ***cobas b*** *221 system > SN 3000.*

Service log file export

This function exports log files to USB mass storage or to a floppy disk.

The naming of the logfile archive is as follows:

logfile_xxxx_yyyyyy_zzzz.pck

x...serial number
y...date
z...time

In case of USB, the destination folder is *Roche\log*.

When there is too little free space on the floppy disk, data can be deleted. If this is confirmed with „Yes", all existing data on the floppy disk will be deleted.

The log file may not be exported during any active procedures (calibration, measurement, fill routines, diagnostics, ...).

Protected DB functions

Delete all databases

This function is used to delete all patient, measurement, QC measurement, calibration and instrument databases.

The instrument will be restarted!

Delete databases & archives

This function deletes all databases and archives (corresponds to backups).

Components

This chapter provides general information about components of the **cobas b** 221 system.

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Important notes

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste container, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

After components have been replaced the previous calibration parameters may have changed and it may be necessary to input new values.

For this reason after modifications the system must be calibrated and then QC measurements must be conducted to adapt the calibration parameters to the new conditions.

Always use screwdrivers of suitable size.

Shutdown

*Unless otherwise specified, always switch off the **cobas b** 221 system before you start modifying it!*

The cobas b 221 system remains switched off for more than 24 hours

☞ Press [System] > [Utilities] > [Put out of operation] and follow the instructions on the screen.

Use only recommended disinfectants to decontaminate the tubing paths!

👁 For details, see *Disinfectants* on page A-7.

Removing the rear panel

1 Switch off the **cobas b** 221 system.

👁 Please pay attention to *Shutdown* on page B-19!

2 Unscrew the screw holding the power supply in place and pull the power supply towards the back.

3 Remove the top cover and the printer cover.

4 Unscrew the five rear-panel screws and remove the rear panel.

Use the reverse order for assembly.

Folding up the central measuring unit

1 Remove the top cover, printer cover and T&D cover of the **cobas b** 221 system.

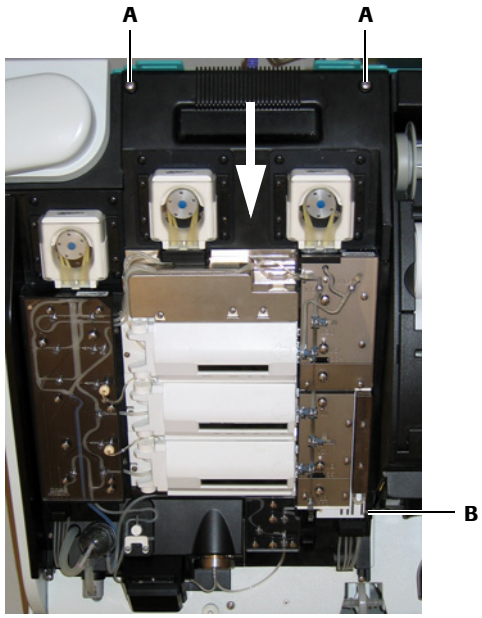
2 Rotate the T&D lock on the T&D module 90 degrees to the right.

👁 For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit (see below).

Do not remove the fastening screws completely, because they are secured against loss.



A Two medium screws **B** One longer crew

Figure B-2 Central measuring unit

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, because otherwise it will be irreparably damaged by raising the central measuring unit.

6 To fold back down the central measuring unit, hold it on the top handle, lift the metal bracket on the left and lower the unit slowly. Be sure that the tubing between V4 and MC cartridge is correctly positioned (see below) and not pinched between central measuring unit and chassis of the instrument.

A Correctly positioned tube

Figure B-3 Tubing V4 – MC cartridge

T&D system (Turn & Dock)

Replacing the T&D module

1 Switch off the **cobas b** 221 system.

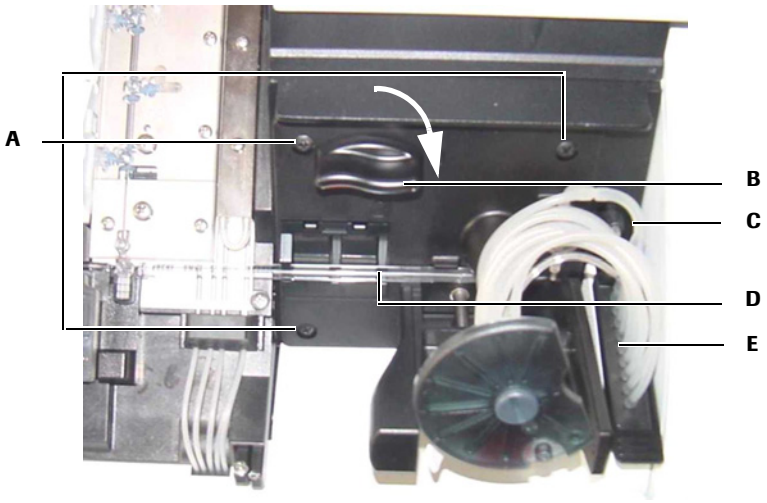
Please pay attention to *Shutdown* on page B-19.

2 Remove the top cover and T&D cover of the **cobas b** 221 system.

3 Rotate the T&D lock on the T&D module 90 degrees to the right (see below).

4 Carefully pull the sample inlet path out to the right and remove it.

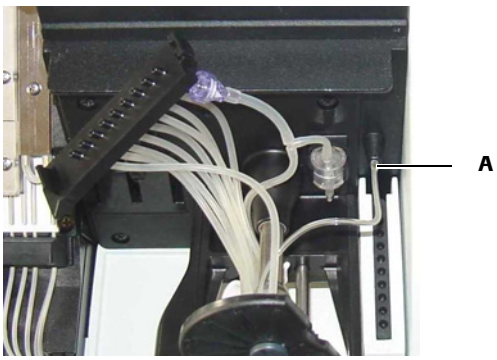
5 Turn the T&D lock back and pull the tubing strip on the right side of the T&D module out of its retainer.



A Three screws fastening the T&D module
B T&D lock
C AutoQC tube
D Sample inlet path
E Tubing strip

Figure B-4 T&D module

6 Unplug the AutoQC tube from the tube connection.



A AutoQC tube

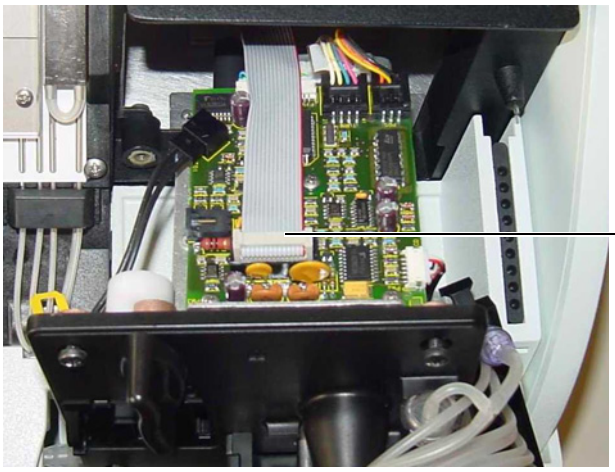
Figure B-5 T&D module - AutoQC tube

7 Unscrew the three screws fastening the T&D module.

For details, see Figure B-4 on page B-22.

Do not remove the fastening screws completely, because they are retained in place by plastic rings to prevent loss.

8 Pull the T&D module forward and unplug the actuator bus cable.



A Actuator bus cable

Figure B-6 T&D module - actuator bus cable

9 Remove T&D module.

Use the reverse order for assembly.

Replacing the fill port

1 Remove T&D cover.

2 Rotate fill port to the right and remove it.

Use the reverse order for assembly.

Replacing the fill port holder

1 Remove T&D cover.

2 Rotate fill port to the right and remove it.

3 Remove the fill port holder from the linear actuators.

Use the reverse order for assembly.

Replacing the needle

1 Remove T&D cover.

2 Rotate fill port to the right and remove it.

3 Rotate needle to the right and remove it.

Use the reverse order for assembly.

After replacing the needle start a T&D needle calibration!
☞ *[Component test] > [Aggregates] > [T&D module]*

Replacing the sample inlet path

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

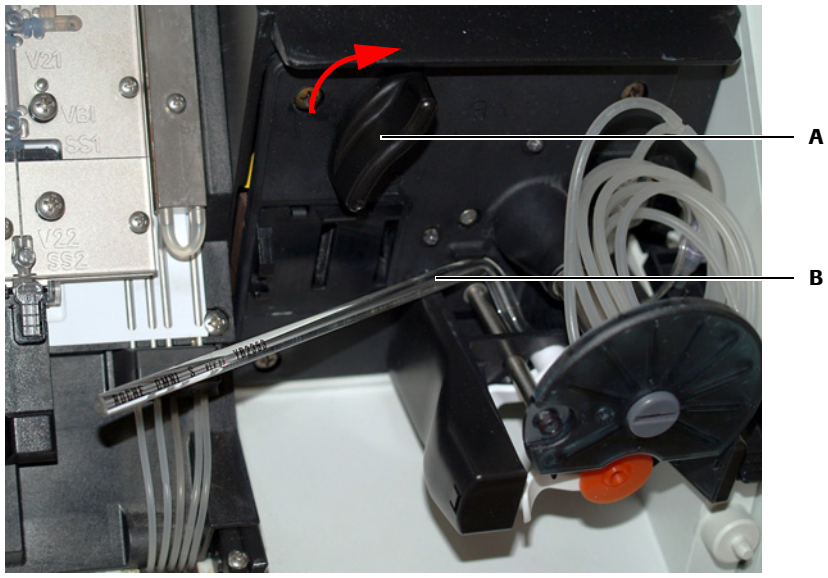
Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Remove the top cover and T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-7 on page B-24.



A T&D lock **B** Sample inlet path

Figure B-7 Replacing the sample inlet path

3 Carefully pull the sample inlet path out to the right and remove it.

Use the reverse order for assembly.

After replacing the sample inlet path start a T&D needle calibration (Component test > Aggregates > T&D module).

Replacing the bypass nipple

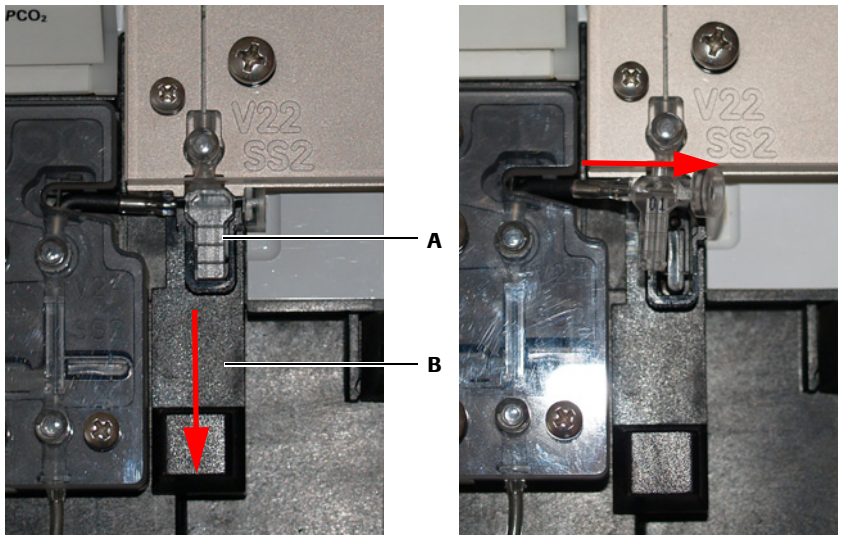
1 Remove the **cobas b** 221 system top cover.

2 Slide the bypass holder down.

For details, see Figure B-8 on page B-25.

3 Pull the bypass nipple up and disconnect it.

For details, see Figure B-8 on page B-25.



A Bypass nipple **B** Bypass holder

Figure B-8 Replacing the bypass nipple

Use the reverse order for assembly.

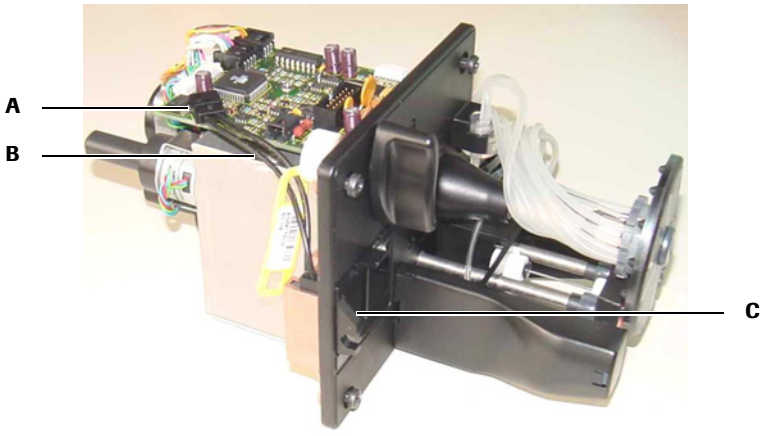
Replacing the optical sensor SS6

1 Disassemble T&D module.

For instructions, see *Replacing the T&D module* on page B-21.

2 Remove the sensor cover on the left side of the T&D module.

3 Hold down the locking button of the sensor plug and pull the sensor plug out.



A Sensor plug **C** Sensor cover
B Sensor SS6

Figure B-9 Sensor SS6

4 Slide the optical sensor out and remove it.

Use the reverse order for assembly.

Note the position of the optical sensor during installation: there are three possible positions and it must be replaced in the one from which it was removed.

Replacing the T&D sensor cover

1 Remove the sample inlet path.

For instructions, see *Replacing the sample inlet path* on page B-24.

2 Remove the sensor cover.

For details, see Figure B-9 on page B-25.

Use the reverse order for assembly.

Replacing the T&D disk

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

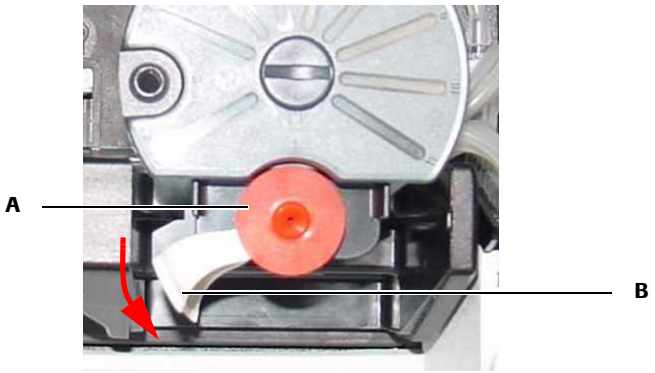
Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

Activate the function program ☞ [System] > [Component test] > [T&D module] and press [P1] to put the T&D disk in the position needed for replacement.

1 Remove T&D cover.

2 Rotate fill port to the right and remove it.



A Fill port **B** Removing the fill port

Figure B-10 Fill port

3 Now use the fill port as a tool:

Insert the fill port with the flat side into the slot in the T&D disk and turn it 90 degrees to the right or left. Hold the T&D disk in place during this process.

4 Remove T&D disk.

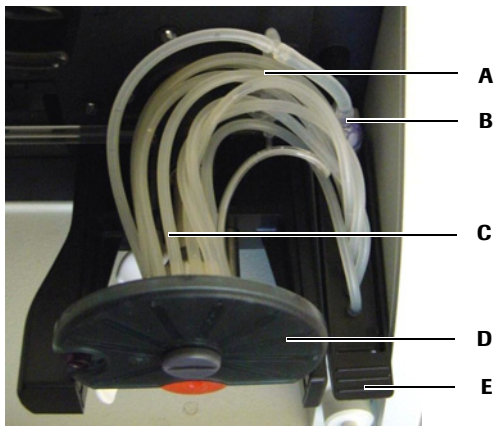
Use the reverse order for assembly.

Replacing the T&D tubing set

1 Remove the T&D disk.

For instructions, see *Replacing the T&D disk* on page B-26.

2 Pull the T&D moisture trap forward.



A Moisture Trap
B Check valve
C Tubing set
D T&D disk
E Tubing strip

Figure B-11 T&D tubing set

3 Pull the tubing strip on the right side of the T&D module upwards from its holder.

4 Unplug the AutoQC tube from the tube connection.

5 Pull the T&D tubing set forward and remove it.

Use the reverse order for assembly.

Make sure that the tubes are correctly positioned in the holder guides when installing the new T&D tubing set.

Replacing the plug control

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

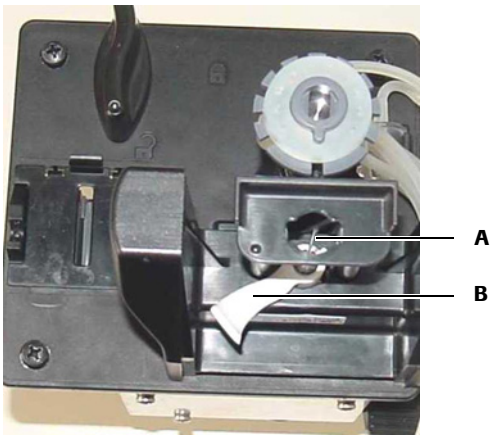
1 Disassemble T&D module.

For instructions, see *Replacing the T&D module* on page B-21.

2 Remove T&D disk.

For instructions, see *Replacing the T&D disk* on page B-26.

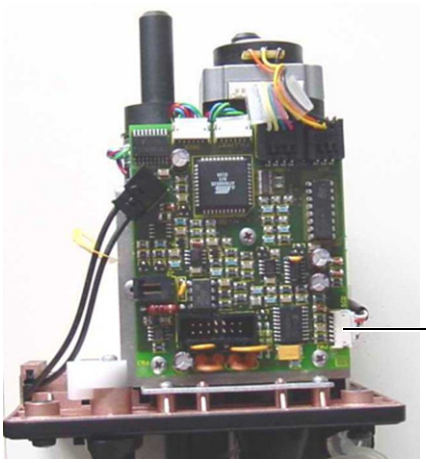
3 Rotate needle to the right with the needle holder and remove it.



A Needle **B** Needle holder

Figure B-12 Needle

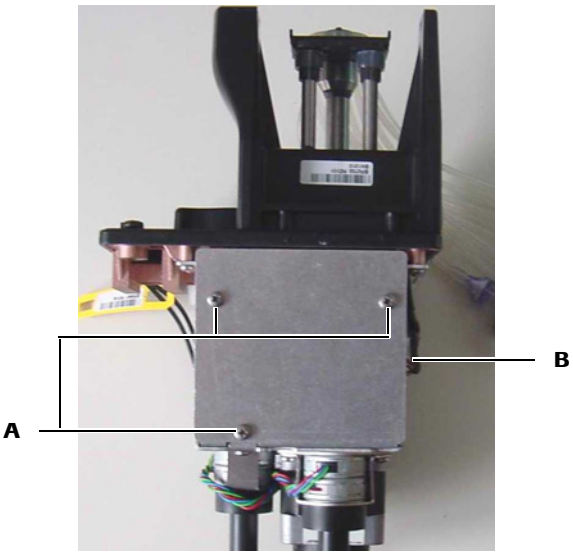
4 Unplug the SCD (Sample Container Detection) cable on the actuator board and slide it out of the holder.



A SCD cable

Figure B-13 T&D module - SCD cable

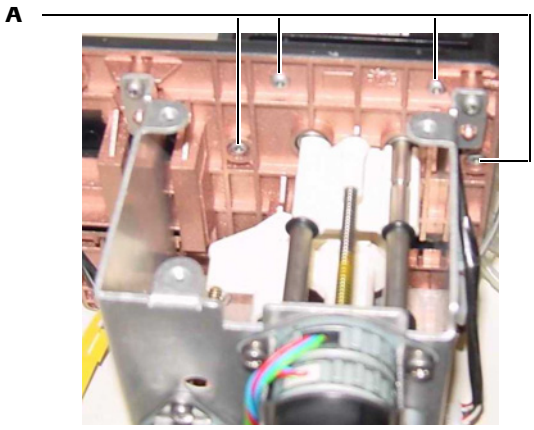
5 Unscrew the three screws holding the housing cover at the bottom of the T&D module and remove the cover.



A Three screws holding the housing cover **B** Housing cover

Figure B-14 T&D module - housing cover on the bottom

6 Unscrew the four screws on the back of the plug control.



A Plug control fixing screws

Figure B-15 T&D module

7 Pull the plug control out to the front.

Use the reverse order for assembly.

Replacing the T&D actuator board

Electrostatically sensitive components!

1 Disassemble T&D module.

For instructions, see *Replacing the T&D module* on page B-21.

2 Disconnect all cables and the optical sensor from the actuator board.

3 Unscrew the three screws holding the actuator boards and remove the actuator board.

Use the reverse order for assembly.

Note the correct positions of the various plug connectors on the cables during installation.

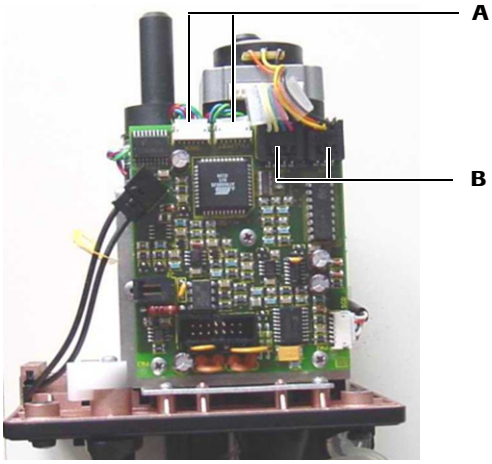
Replacing the stepper motor

Electrostatically sensitive components!

1 Disassemble T&D module.

For instructions, see *Replacing the T&D module* on page B-21.

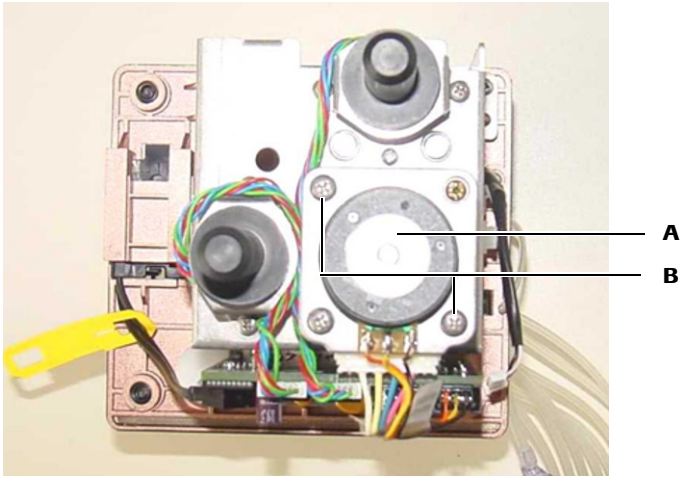
2 Disconnect the two plugs (labeled POS and TURN) from the actuator board.



A Linear actuator connectors **B** "POS" and "TURN" connectors

Figure B-16 T&D module - Actuator board

3 Unscrew the screws (stainless steel) holding the stepper motor and remove the stepper motor (see below, B).



A T&D stepper motor **B** Screws holding the stepper motor

Figure B-17 T&D stepper motor

Use the reverse order for assembly.

Replacing the T&D linear actuators

Electrostatically sensitive components!

1 Disassemble T&D module.

For instructions, see *Replacing the T&D module* on page B-21.

2 Remove T&D disk.

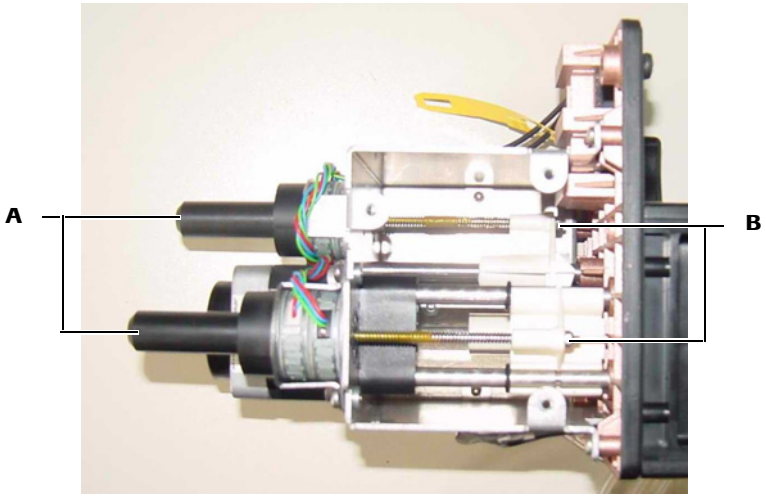
For instructions, see *Replacing the T&D disk* on page B-26.

3 Disconnect the linear actuator plug on the actuator board.

4 Unscrew the three screws holding the housing cover at the bottom of the T&D module and remove the cover.

5 Unscrew the two screws holding the linear actuator.

6 Unscrew the spindle nut of the linear actuator with a 4.5 mm wrench and remove it together with the washer.



A Linear actuators **B** Spindle nuts

Figure B-18 T&D module - linear actuators

7 Pull the linear actuator back and remove it.

8 Remove the spindle cover and support plate from the linear actuator and fasten to the new one.

Use the reverse order for assembly.

Before assembling the new linear actuator, unscrew the spindle 1 cm on the motor side to ensure that the front end of the spindle does not press against the tube of the sample distributor cartridge during installation.

Fluid mixing system (FMS)

Replacing the FMS

Electrostatically sensitive components!

1 Remove the rear panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

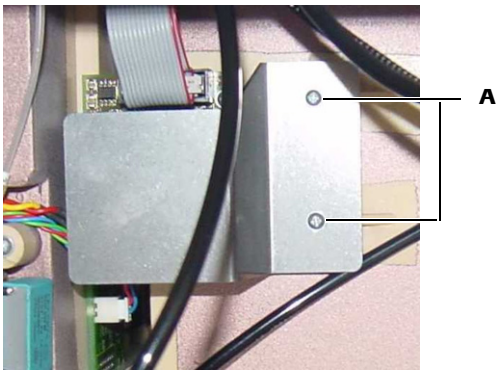
2 Remove T&D cover.

3 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

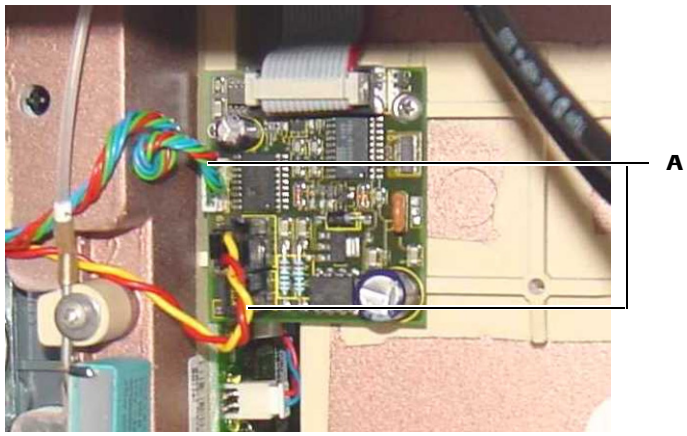
4 If an AutoQC module (optional) is installed in the **cobas b** 221 system, remove it to allow free access to the FMS (from the back of the instrument).

5 Unscrew the two screws holding the plug protective plate of the control board and remove the protective plate (see below, A).



A Two screws

Figure B-19 FMS control board-1



A Cable connectors (red/greet/blue, yellow/red)

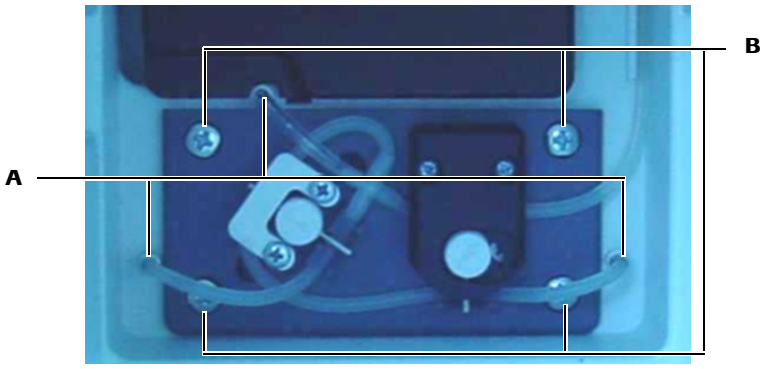
Figure B-20 FMS control board-2

6 Disconnect the two FMS cable connectors on the board (see above).

7 Disconnect the two cable connectors (ground) from the FMS actuators.

8 Open the bottle compartment cover and remove all bottles or packs from the **cobas b** 221 system.

9 Disconnect all tube connections exiting from the FMS (see below, A).



A Tube connections **B** FMS holding screws

Figure B-21 FMS unit

10 Unscrew the four screws (see above, B) holding the FMS and pull the FMS forward.

Do not remove the fastening screws completely, because they are secured against loss.

Use the reverse order for assembly.

Test the functioning of the FMS valves (V19 and VM) under ☞ [System] > [Component test] > [Valves] > [FMS].

Replacing the FMS control board

Electrostatically sensitive components!

1 Remove the rear panel.

For instructions, see *Removing the rear panel* on page B-20.

2 If an AutoQC module (optional) is installed in the **cobas b** 221 system, remove it to allow free access to the FMS (from the back of the instrument).

3 Unscrew the two screws holding the plug protection plate of the actuator board and remove the plug protection plate.

For details, see: Figure B-19 on page B-33.

4 Pull out all plug connectors on the FMS control board.

5 Unscrew the two screws holding the FMS control board and remove the board.

Use the reverse order for assembly.

Replacing the FMS tubing set

Activate the function program ☞ [System] > [Utilities] > [Maintenance] > [Change FMS tubing] and follow the instructions on the screen.

Sample distributor (SD)

Replacing the sample distributor cartridge

Activate the function program ☞ [System] > [Utilities] > [Maintenance] > [Change SD cartridge] to position all valve actuators correctly.

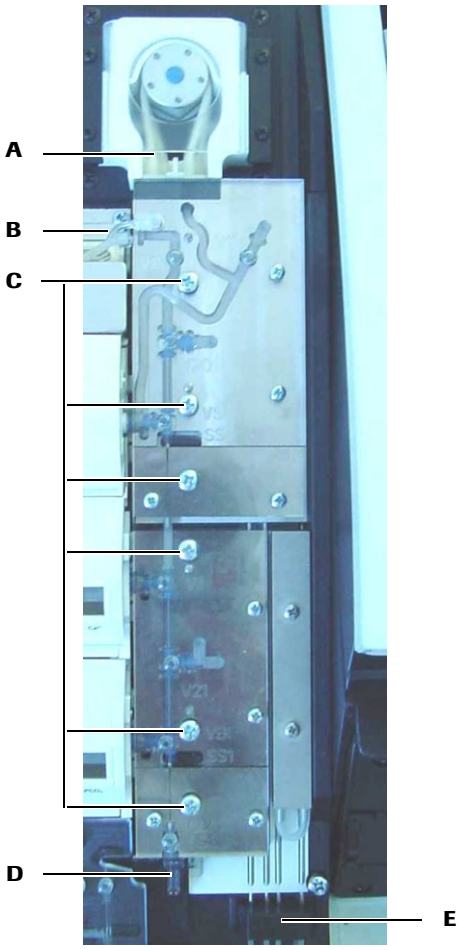
1 Remove the top cover and T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Disconnect the two tubes that run from the sample distributor cartridge to the measuring chamber cartridge.



A Linear clamp
B Tubes to measuring chamber cartridge
C Six screws holding the sample distributor cartridge
D Bypass nipple
E Sample distributor liquid connection

Figure B-22 Sample distributor cartridge

5 Open the locking lever (Plexiglas cover) of the MSS input pump and slide the linear clip (white plastic piece) upwards.

6 Slide the bypass holder down and raise the bypass nipple.

For details, see Figure B-8 *Replacing the bypass nipple* on page B-25.

7 Unscrew the six screws holding the sample distributor cartridge and pull the sample distributor cartridge up and to the right.

For details, see Figure B-22 on page B-36.

Do not open the cartridge!

Do not open the cartridge during replacement.

Do not remove the fastening screws completely, because they are secured against loss.

Use the reverse order for assembly.

Make sure that there is no contamination between heating plate and sample distributor cartridge.

Replacing the sample distributor

Electrostatically sensitive components!

1 Disassemble the sample distributor cartridge.

👁 For instructions, see *Replacing the sample distributor cartridge* on page B-35.

2 Remove printer cover.

3 Unscrew the three screws holding the central measuring unit.

👁 For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

4 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, because otherwise it will be irreparably damaged by raising the central measuring unit.

5 Disassemble the **cobas b** 221 system fan unit.

👁 For instructions, see *Replacing the main fan unit* on page B-110.

6 Unscrew the two screws holding the mainboard unit.

👁 For details, see Figure B-66 on page B-89.

7 Fold the mainboard unit down.

8 Disconnect the two MSS measuring chamber connector cables on the mainboard and remove the MSS measuring chamber.

👁 For instructions, see *Replacing the MSS measuring chamber* on page B-44.

9 Remove the ISE measuring chamber.

👁 For instructions, see *Replacing the ISE measuring chamber* on page B-42.

10 Remove the BG measuring chamber.

👁 For instructions, see *Replacing the BG measuring chamber* on page B-40.

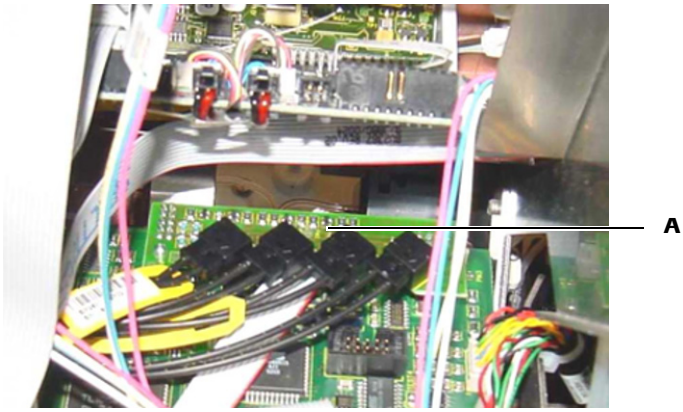
11 Remove the Hb cartridge.

👁 For instructions, see *Replacing the Hb cartridge* on page B-63.

12 Disconnect the two connector cables of the sample distributor (name: PELT-QK, VB) on the mainboard.

13 Disconnect the two capacitor mainboard connecting wires on the sample distributor.

14 Disconnect the sample sensor board from the mainboard.



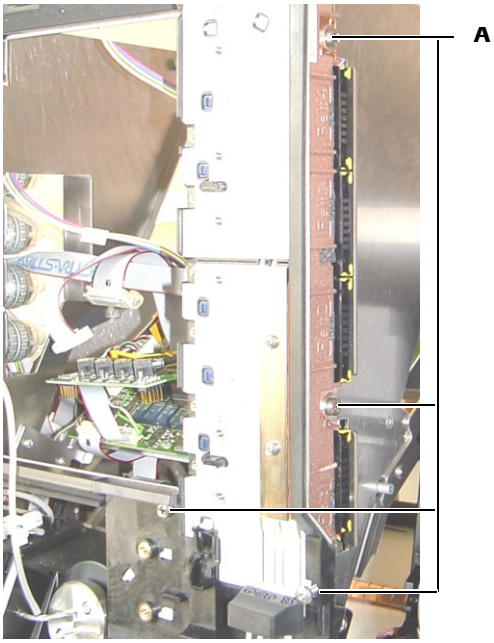
A Sample sensor board

Figure B-23 Sample sensor board

15 Pull the liquid connector of the sample distributor down.

For details, see Figure B-22 on page B-36.

16 Unscrew the four screws holding the sample distributor (see below, A).



A Four screws

Figure B-24 Fastening screws of the sample distributor

17 Pull the sample distributor unit forward and remove it.

Use the reverse order for assembly.

Make sure that there is no contamination between heating plate and sample distributor cartridge.

When installing the BG, ISE and MSS modules, make sure not to confuse the modules and plug-in connectors!

During assembly, ensure the correct installation of the fluid seal between lateral channel and pump frame!

Replacing the SS1, SS2, SS3 and SS4 optical sensors

Electrostatically sensitive components!

1 Remove the top cover, printer cover and T&D cover of the **cobas b** 221 system.

2 SS1, SS2, SS4: disassemble the sample distributor cartridge.

For instructions, see *Replacing the sample distributor cartridge* on page B-35.

SS3: disassemble the Hb cartridge.

For instructions, see *Replacing the Hb cartridge* on page B-63.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Disassemble the **cobas b** 221 system fan unit.

For instructions, see *Replacing the main fan unit* on page B-110.

8 Unscrew the two screws holding the mainboard unit.

For details, see Figure B-66 on page B-89.

9 Fold the mainboard unit down.

10 Disconnect the sensor on the sample sensor board.

For instructions, see *Replacing the sample sensor board* on page B-91.

11 **Optical sensor SS1:**

a) Disassemble the mainboard unit.

For instructions, see *Replacing the Mainboard unit* on page B-89.

b) Unscrew the two screws holding the VBI valve.

For details, see Figure B-62 on page B-83.

c) Remove the valve. Now slide the sensor out and remove it.

Optical sensor SS2:

a) Disassemble the mainboard unit.

For instructions, see *Replacing the Mainboard unit* on page B-89.

b) Unscrew the two screws holding the V22 valve.

For details, see Figure B-62 on page B-83.

c) Remove the valve. Now slide the sensor out and remove it.

Optical sensor SS3:

a) Disassemble the mainboard unit.

For instructions, see *Replacing the Mainboard unit* on page B-89.

b) Unscrew the two screws holding the V2 valve.

For details, see Figure B-62 on page B-83.

c) Remove the valve. Now slide the sensor out and remove it.

Optical sensor SS4:

a) Unscrew the two screws holding the VSI valve.

For details, see Figure B-62 on page B-83.

b) Remove the valve. Now slide the sensor out and remove it.

Use the reverse order for assembly.

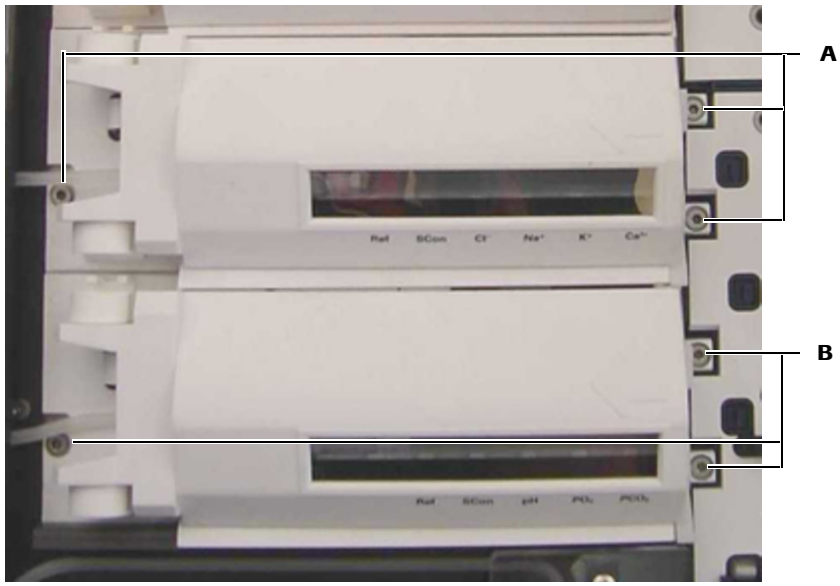
BG measuring chamber

Replacing the BG measuring chamber

1. Disassemble the sample distributor cartridge.

For instructions, see *Replacing the sample distributor cartridge* on page B-35.

2. Open the BG measuring chamber, remove the electrodes and the electrode locking lever and pull out the tube to the measuring chamber cartridge on the left side.
3. Close the measuring chamber and unscrew the three screws holding the BG module (see below, B)



A Three screws holding the ISE module **B** Three screws holding the BG module

Figure B-25 Screws holding the BG and ISE modules

4 Unscrew the three screws holding the ISE module (see above, A).

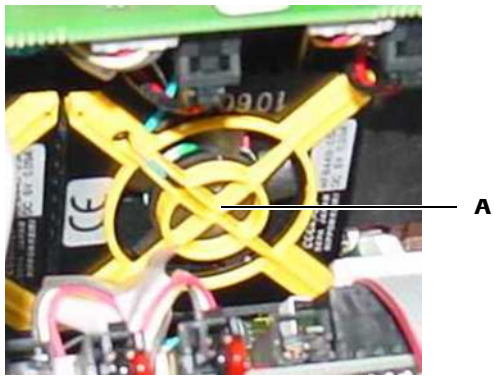
5 Lift the ISE module and pull the BG module forward.

6 Disconnect the mainboard plugs from the BG module and remove the BG module.

Use the reverse order for assembly.

Make sure that there is no contamination between heating plate and sample distributor cartridge.

Replacing the fan protector (BG module)



A Fan protector

Figure B-26 Fan protector

1 Disassemble the BG module.

For instructions, see *Replacing the BG measuring chamber* on page B-40.

2 Release the four hooks at the end of the fan protector.

3 Lever the head of the NTC cable out of the fan protector with a screwdriver and slide the cable out.

4 Remove the fan protector.

Use the reverse order for assembly.

Replacing the electrode locking lever (BG module)

1 Remove the **cobas b** 221 system top cover, open the BG measuring chamber and remove the electrodes.

2 Half open the electrode locking lever, hold it in place with both hands and pull it up.

3 Disconnect the tube and remove the electrode locking lever.

Use the reverse order for assembly.

Replacing the center seal (BG module)

1 Remove the **cobas b** 221 system top cover and open the BG measuring chamber.

2 Open the electrode locking lever.

3 Remove the electrodes.

4 Remove the center seal (blue plastic ring on the right interior panel) with tweezers.

Use the reverse order for assembly.

Do not use tools to install the new center seal, otherwise it may be damaged.

ISE measuring chamber (cobas b 221<3>–<6> systems only)

Replacing the ISE measuring chamber

1 Disassemble the sample distributor cartridge.

For instructions, see *Replacing the sample distributor cartridge* on page B-35.

2 Open the ISE measuring chamber, remove the electrodes and the electrode locking lever and pull out the tube to the measuring chamber cartridge on the left side.

3 Close measuring chamber and unscrew the three screws holding the ISE module.

For details, see Figure B-25 on page B-41.

4 Disconnect the tube adapter to the MSS output pump.

5 Unscrew the five screws holding the MSS module.

6 Lift the MSS module and pull the ISE module forward.

7 Remove the board plug from the ISE module and remove the ISE module.

Use the reverse order for assembly.

Make sure that there is no contamination between heating plate and sample distributor cartridge.

Replacing the fan protector (ISE module)

1 Disassemble the ISE module.

For instructions, see *Replacing the ISE measuring chamber* on page B-42.

2 Loosen the four hooks at the ends of the fan protector.

For details, see Figure B-26 on page B-41.

3 Release the head of the NTC cable from the fan protector with a screwdriver and slide it out.

4 Remove fan protector.

Use the reverse order for assembly.

Replacing the electrode locking lever (ISE module)

1 Remove the **cobas b** 221 system top cover and open the ISE measuring chamber.

2 Half open the electrode locking lever, hold it in place with both hands and pull it up.

3 Disconnect the tube and remove the electrode locking lever.

Use the reverse order for assembly.

Replacing the center seal (ISE module)

1 Remove the **cobas b** 221 system top cover and open the ISE measuring chamber.

2 Open the electrode locking lever.

3 Remove the electrodes.

4 Remove the center seal (blue plastic ring on the right interior panel) with tweezers.

Use the reverse order for assembly.

Do not use tools to install the new center seal, otherwise it may be damaged.

MSS measuring chamber (cobas b 221<5/6> systems only)

Replacing the MSS measuring chamber

Electrostatically sensitive components!

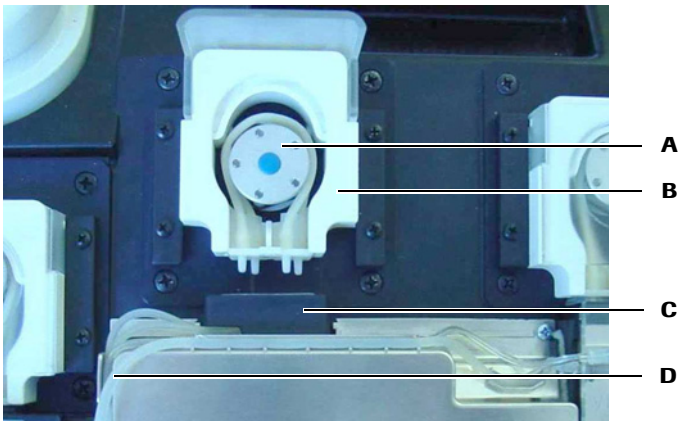
1 Disassemble the sample distributor cartridge.

For instructions, see *Replacing the sample distributor cartridge* on page B-35.

2 Open the locking lever (Plexiglas cover) of the MSS output pump and slide the linear clamp (white plastic part) up.

For details, see Figure B-46 on page B-65.

3 Pull the tubes out of the tube guide and remove the tube adapter from the MSS module.



A MSS output pump
B Linear clamp
C Tube adapter
D Tube guide

Figure B-27 Tube adapter

4 Open the MSS measuring chamber, remove the electrodes and the MSS cassette and pull out the tube on the left side.

5 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

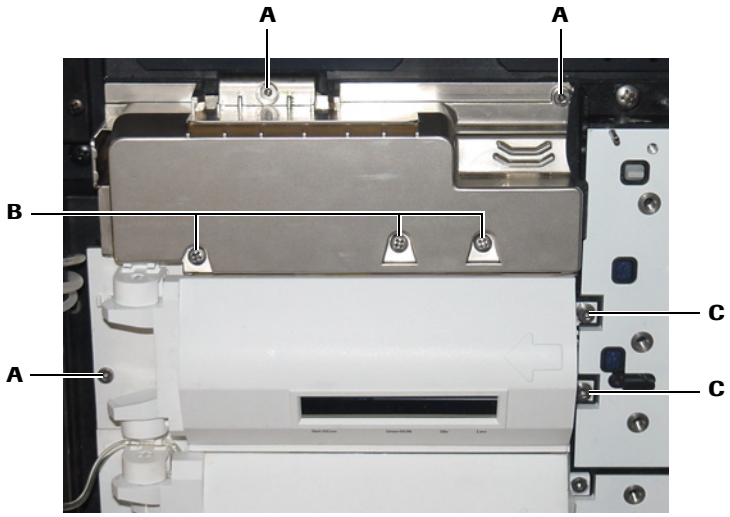
Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Disconnect the two MSS connecting cables on the mainboard.

8 Unscrew the five screws (internal hex) holding the MSS module and remove the module (see below, A and C).



A Three module screws without washers
B Three screws (internal hex)
C Two module screws with washers

Figure B-28 MSS module screws

9 Slide the new MSS module into position, starting from the left to the right.

Treat module sealings carefully!

When sliding the new MSS module into position, treat the module sealings carefully. Slide the module into position starting from the left to the right. Align the module properly and gently push it into position.

10 Align the module and gently push it into position. Keep pushing the module on the right top.

11 Tighten the five MSS module screws (internal hex) beginning at the top right (see above, A) proceeding counter-clockwise and at last tighten the screws with washers (see above, C).

Use step 7 backwards for remaining assembly.

Make sure that there is no contamination between heating plate and sample distributor cartridge.

Replacing the MSS MC cover

1 Remove the **cobas b** 221 system top cover and open the MSS measuring chamber.

2 Pull the MC cover upward.

Use the reverse order for assembly.

Replacing the MSS clip

Electrostatically sensitive components!

1 Remove the **cobas b** 221 system top cover and open the MSS measuring chamber.

2 Unscrew the screws marked A and B of the MSS module and open the module.

👁 For details, see Figure B-28 on page B-45.

Do not remove the fastening screws completely, because they are secured against loss.

3 Remove the MSS clip.

Use the reverse order for assembly.

Replacing the fan protector (MSS module)

1 Disassemble the MSS module.

👁 For instructions, see *Replacing the MSS measuring chamber* on page B-44.

2 Loosen the four hooks at the ends of the fan protector.

👁 For details, see Figure B-26 on page B-41.

3 Release the head of the NTC cable from the fan protector with a screwdriver and slide it out.

4 Remove the fan protector.

Use the reverse order for assembly.

Replacing the electrode locking lever (MSS module)

1 Remove the **cobas b** 221 system top cover and open the MSS measuring chamber.

2 Half open the electrode locking lever, hold it in place with both hands and pull it up.

3 Disconnect the tube and remove the electrode locking lever.

Use the reverse order for assembly.

Replacing the center seal (MSS module)

1 Remove the **cobas b** 221 system top cover and open the MSS measuring chamber.

2 Open the electrode locking lever.

3 Remove electrodes and MSS-cartridge.

4 Remove the center seal (blue plastic ring on the right interior panel) with tweezers.

Use the reverse order for assembly.

Do not use tools to install the new center seal, otherwise it may be damaged.

Replacing the MSS measuring chamber amplifier

Electrostatically sensitive components!

1 Remove the top cover and the T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

👁 For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

👁 For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disassemble the fan shield.

👁 For instructions, see *Replacing the main fan unit* on page B-110.

7 Disconnect the MSS connector cable on the mainboard.

8 Unscrew the screws marked A and B of the MSS module and open the module.

👁 For details, see Figure B-28 on page B-45.

9 Remove the MSS clip, the MSS cover and the amplifier board of the MSS measuring chamber from above and pull the amplifier out to the back.

Use the reverse order for assembly.

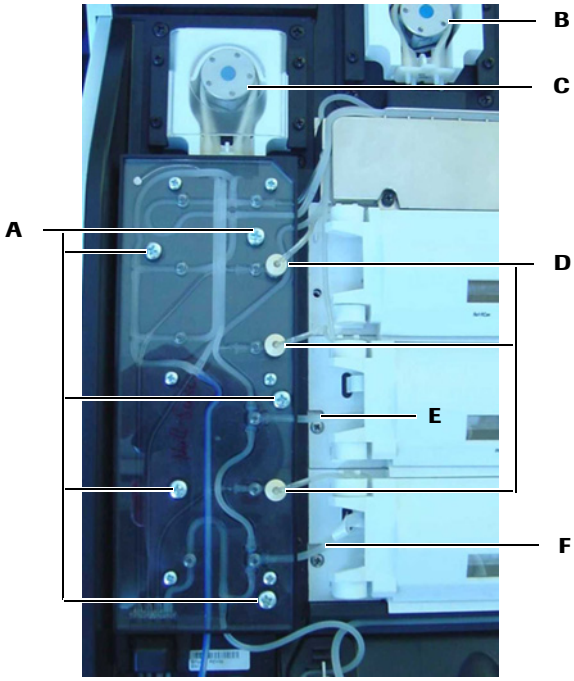
Measuring chamber cartridge

Replacing the measuring chamber cartridge

Activate the function program ☞ [System] > [Utilities] > [Maintenance] > [Change MC cartridge] to position all valve actuators correctly.

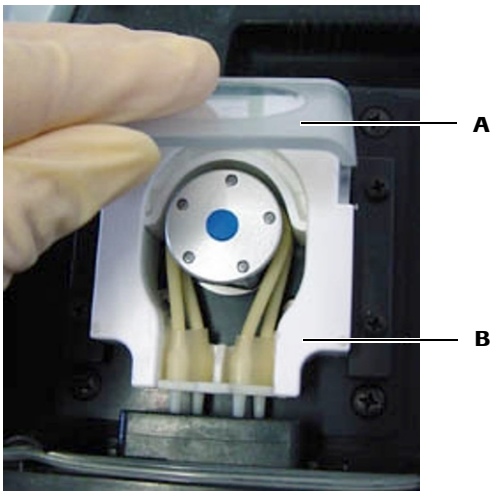
1 Remove the top cover.

2 Disconnect all tubes on the measuring chamber cartridge (see below, D).



A Five crews holding the measure chamber cartridge
B MSS output pump
C Main pump
D Tubes
E Chamber outlet tube of the ISE measuring chamber
F Chamber outlet tube of the BG measuring chamber

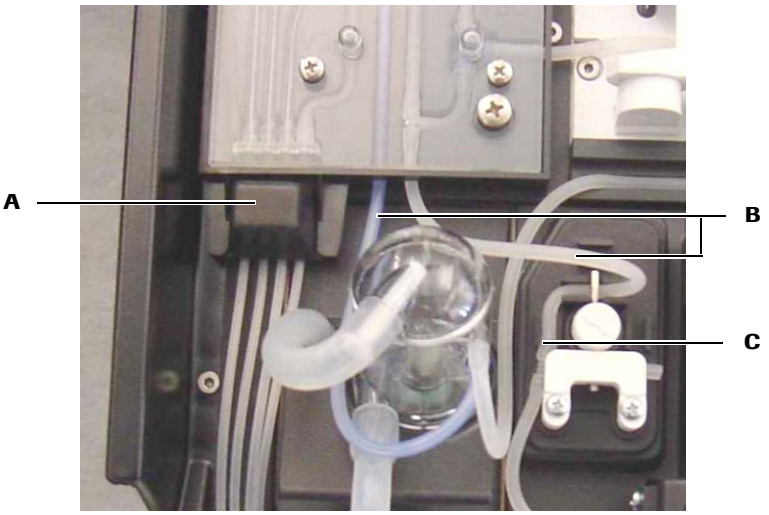
Figure B-29 Measuring chamber cartridge - 1



A Tension lever **B** Linear clamp

Figure B-30 Measuring chamber cartridge - 2

3 Disconnect tube adapter to the bottle compartment, the connector tube to the waste separator and the connector tube to V4 on the T-piece (see below).



A Tube adapter **C** T-piece
B Connector tubes

Figure B-31 MC tube adapter

4 Open the BG measuring chamber and disconnect the measuring chamber outlet tube.

For details, see Figure B-29 on page B-48.

5 Open the ISE measuring chamber and disconnect the measuring chamber outlet tube.

For details, see Figure B-29 on page B-48.

6 Open the locking lever (Plexiglas cover) of the main pump and the MSS output pump and slide the linear clamp (white plastic part) up.

For details, see Figure B-46 on page B-65.

7 Remove the tube adapter from the MSS module.

8 Disconnect the two tubes that run from the sample distributor cartridge to the measuring chamber cartridge.

For details, see Figure B-22 on page B-36.

9 Unscrew the five screws holding the measuring chamber cartridge.

For details, see Figure B-29 on page B-48.

Do not open the cartridge!

Do not open the cartridge during replacement.

Do not remove the fastening screws completely, because they are secured against loss.

10 Pull the measuring chamber cartridge up and remove it.

Use the reverse order for assembly.

Replacing the MC Actor Control Board

Electrostatically sensitive components!

1 Remove the top cover and the T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect all valves of the measuring cartridge and the valve bus cable on the MC Actor Control Board. Note the valve plug labels printed on the MC Actor Control Board.

7 Lever the MC Actor Control Board from the snap fastener and remove it.

Use the reverse order for assembly.

COOX module (cobas b 221<2/4/6> systems only)

Overview

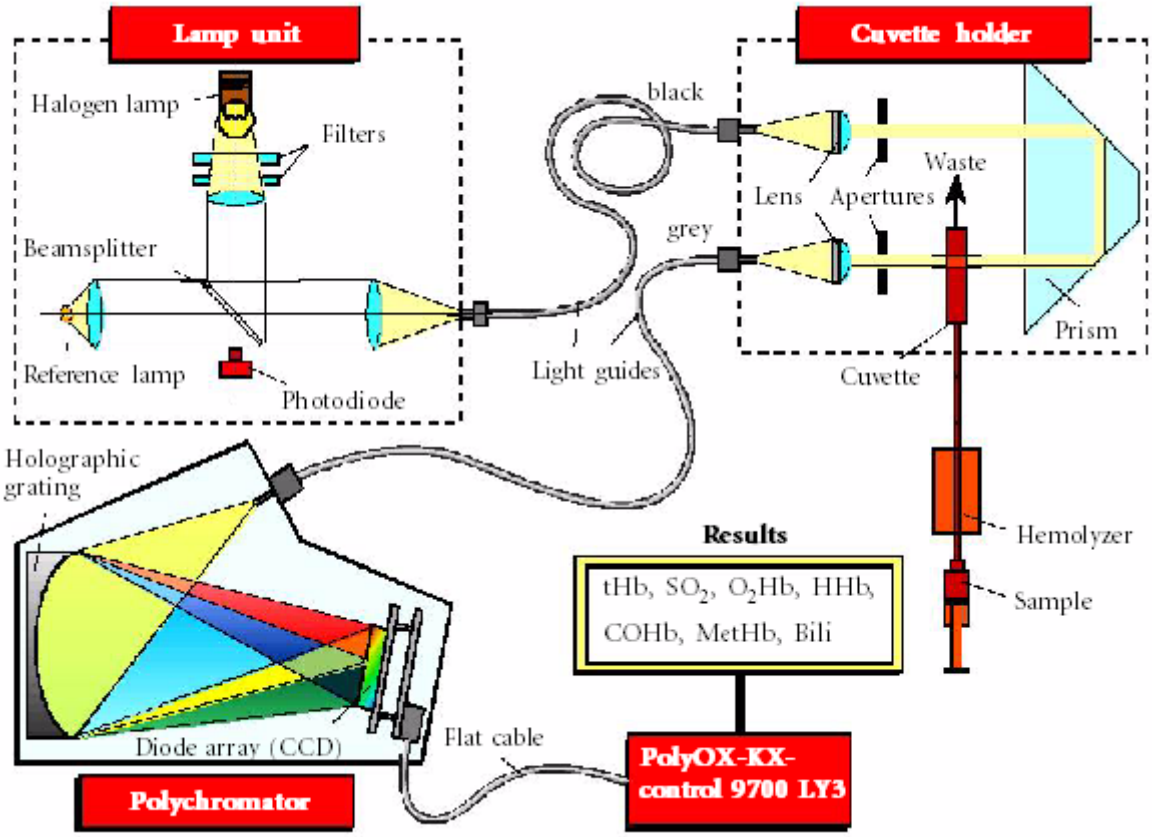


Figure B-32 COOX module: Overview

Replacing the lamp unit bilirubin

Electrostatically sensitive components!

1 Remove the rear panel of the instrument.

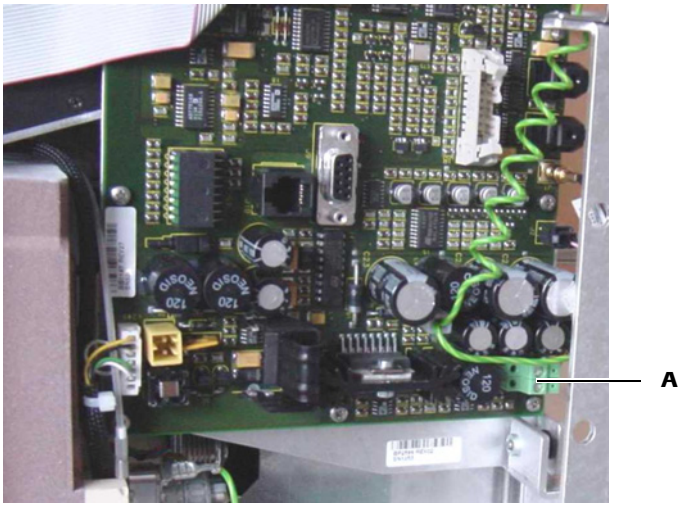
For instructions, see *Removing the rear panel* on page B-20.

2 Remove the T&D cover of the **cobas b** 221 system.

3 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

4 Loosen the two cable clamp screws on the PolyOX-KX control board.

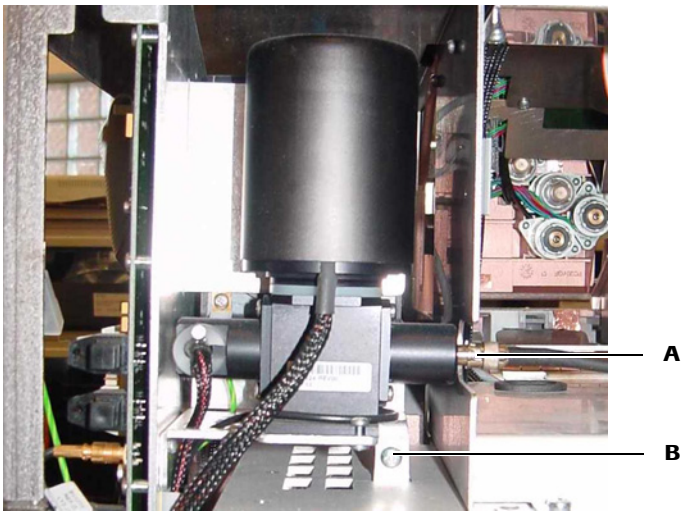


A Cable clamp

Figure B-33 PolyOX-KX control board - cable clamp

5 Disconnect the power supply cable (identification: J7) and the two lamp plugs on the lamp unit (identification: J1, J2) on the board.

6 Open the bayonet closure of the primary light guide and pull it off (see below).



A Bayonet closure **B** Holding screw

Figure B-34 Lamp unit bilirubin

7 Unscrew the screw holding the lamp unit (see above).

8 Release the cable from the flat cable clip.

9 Remove the lamp unit.

Use the reverse order for assembly.

Replacing the PolyOX-KX control board

Electrostatically sensitive components!

1 Remove the rear panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

2 Remove the T&D cover of the **cobas b** 221 system.

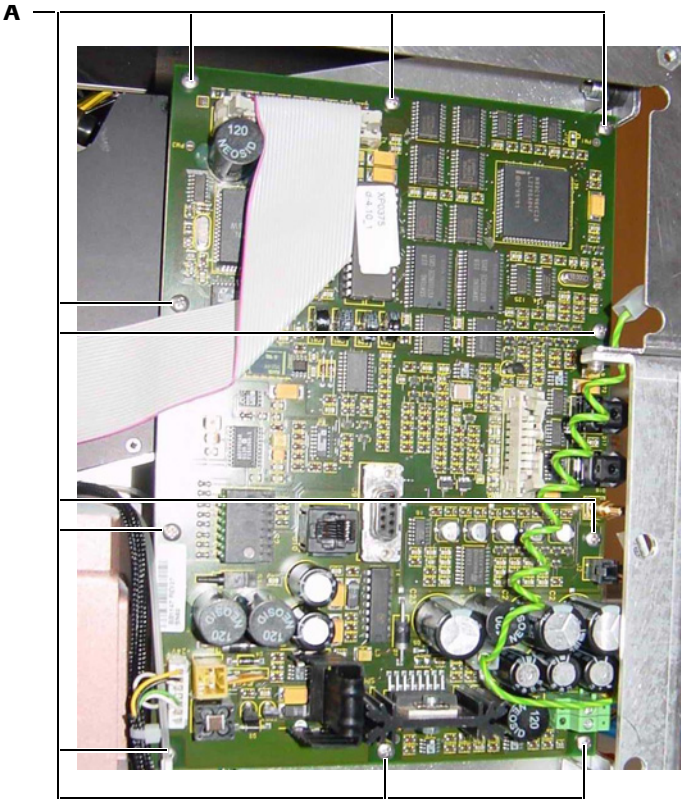
3 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

4 Loosen the two cable clamp screws.

5 Remove all plug connectors (identification: J1, J2, J3, J7, J16) and the ground from the PolyOX-KX control board.

6 Unscrew the ten screws holding the PolyOX-KX control board.



A Ten screws

Figure B-35 PolyOX-KX Control Board

7 Pull the PolyOX-KX control board out from the side and remove it.

Use the reverse order for assembly.

Replacing the Polychromator Bilirubin

After replacing the polychromator bilirubin, a code must be entered in the protected setup. For this purpose, record the 16 digit code located on the polychromator bilirubin!

For instructions, see *COOX module (cobas b 221<2/4/6> systems only)* on page B-10.

1 Remove the rear panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

2 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

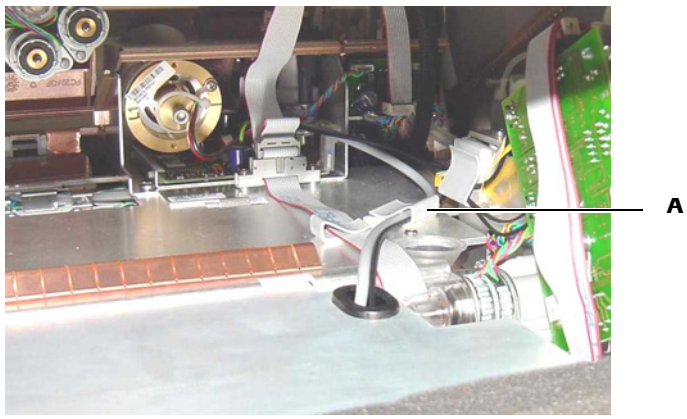
5 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Pull the two light guides out of the clamp.



A Light guide clamp

Figure B-36 Light guide clamp

8 Disconnect the two tubes from the cuvette holder and open the cuvette holder.

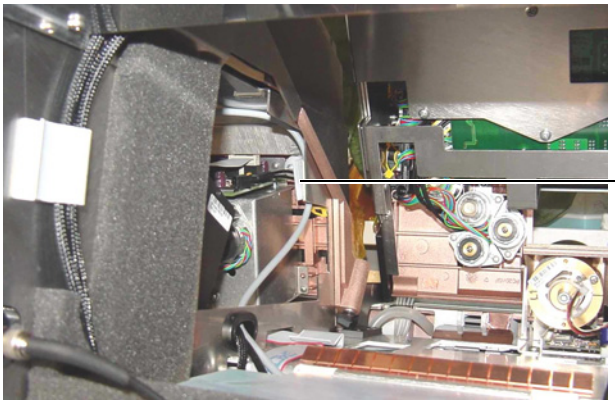
For details, see Figure B-41 on page B-58.

9 Unscrew the two screws holding the cuvette holder and pull out the cuvette holder to the front.

For details, see Figure B-41 on page B-58.

10 Disconnect the light guide (gray) leading to the polychromator from the cuvette holder and slide it out to the back.

11 Pull the light guide leading to the polychromator out of the clamp beside the polychromator and slide it out to the right.



A Light guide clamp

Figure B-37 Clamp beside polychromator

12 Open the bayonet closure of the primary light guide on the lamp unit and remove it.

For details, see Figure B-34 on page B-52.

13 Unscrew the two screws holding the light guide conduit and pull the light guide conduit out to the back.

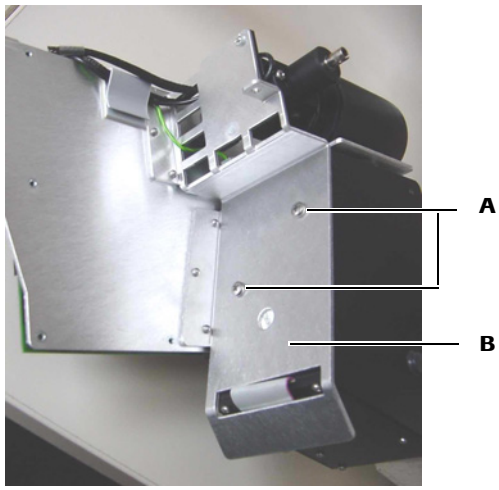
For details, see Figure B-40 on page B-57.

14 Remove the plugs from the power supply (from the PolyOX-KX control board, name: J16) and ground (from frame).

15 Unscrew the three screws holding the COOX module and remove the COOX module.

16 Disconnect the flat cable from the polychromator bilirubin.

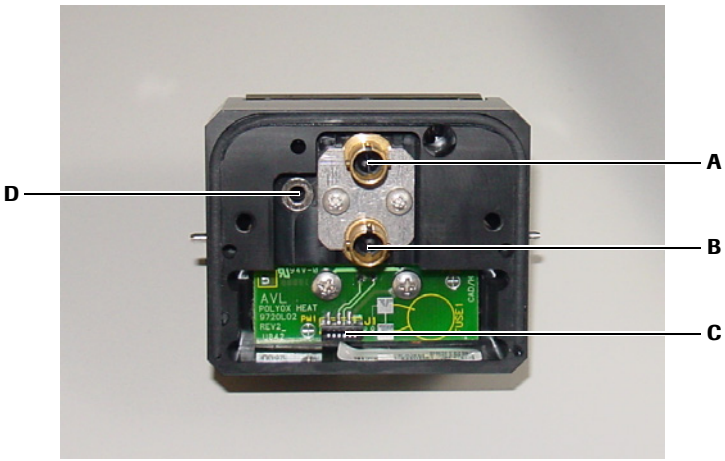
17 Unscrew the two screws at the bottom of the polychromator bilirubin and remove it.



A Screws **B** Polychromator Bilirubin

Figure B-38 Polychromator Bilirubin

Use the reverse order for assembly.



A Light guide (black) **C** Cable to HSIN board
B Light guide (grey) **D** Ground cable connection

Figure B-39 Connections of the cuvette holder

Make sure that the bayonet connector is properly locked when reconnecting the light guide!

Replacing the primary light guide

1. Remove the rear panel of the instrument.

   For instructions, see *Removing the rear panel* on page B-20.

2. Rotate the T&D lock on the T&D module 90 degrees to the right.

   For detail, see Figure B-4 on page B-22.

3. Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Pull the primary light guide and the light guide for bilirubin out of the clamp.

For details, see Figure B-36 on page B-54.

7 Disconnect the two tubes from the cuvette holder and open the cuvette holder.

For details, see Figure B-41 on page B-58.

8 Unscrew the two screws holding the cuvette holder and pull out the cuvette holder to the front.

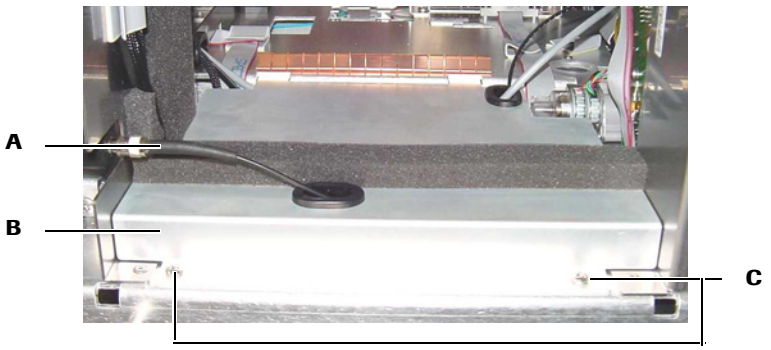
For details, see Figure B-41 on page B-58.

9 Disconnect the primary light guide and the light guide for bilirubin from the cuvette holder and slide them out to the back.

Never bend the primary light guide, because this may damage it.

10 Open the bayonet closure of the primary light guide plug and remove it.

11 Unscrew the two screws holding the light guide conduit and pull the light guide conduit out to the back (see below, C).



A Primary light guide
B Light guide conduit
C Two screws holding the light guide conduit

Figure B-40 Light guide conduit

Use the reverse order for assembly.

Replacing the cuvette holder

1 Remove the top cover, the printer cover and the T&D cover of the instrument.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

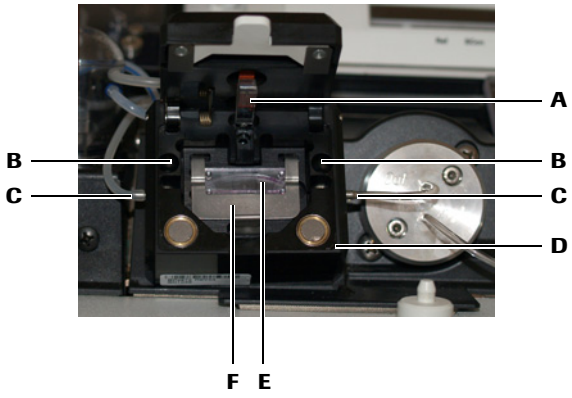
5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Remove the two light guides from the clamp.

For details, see Figure B-36 on page B-54.

7 Disconnect the two tubes from the cuvette holder and open the cuvette holder.



A	Prism	**D**	Cuvette holder
B	Two screws	**E**	Cuvette
C	Two tubes	**F**	Cuvette retainer

Figure B-41 Cuvette holder

8 Unscrew the two screws holding the cuvette holder and pull the cuvette holder out to the front.

For details, see Figure B-41 on page B-58.

9 Disconnect the two light guides and the flat cable from the cuvette holder and slide it out to the back.

10 Disconnect the cuvette holder ground cable from the frame.

11 Remove the cuvette holder.

Use the reverse order for assembly.

Replacing the cuvette

1 Remove the **cobas b** 221 system top cover and open the cuvette holder.

2 Open the retainer and remove the cuvette.

Use the reverse order for assembly.

After replacing the cuvette, perform a COOX calibration using tHb calibrator or a blood sample whose tHb value is exactly known:

For instructions, see **cobas b** 221 system Instructions for Use, section "COOX calibration".

3 Perform a COOX calibration and enter "Yes" at "Cuvette replaced".

4 Confirm the message "COOX calibration performed" by pressing "Ok".

5 Perform another COOX calibration and enter "No" at "Cuvette replaced".

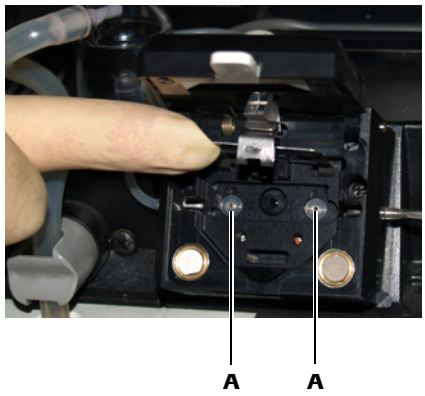
The COOX module will be ready for measurement after accepting the second calibration.

Replacing the cuvette seals

1 Remove the **cobas b** 221 system top cover and open the cuvette holder.

2 Open the retainer and remove the cuvette.

3 Remove the two cuvette seals with tweezers.



A Two seals

Figure B-42 Cuvette seals

Use the reverse order for assembly.

Replacing the tubing set tHb/PolyOX

Activate the function program ☞ [System] > [Utilities] > [Maintenance] > [Change Hb cartridge] to position all valve actuators correctly.

1 Remove the top cover.

2 Disconnect the left tube from the cuvette holder.

For details, see Figure B-41 on page B-58.

3 Disconnect the connector tube to V4 on the T-piece and remove tubing set tHb/ PolyOX..

For details, see Figure B-41 on page B-58.

Use the reverse order for assembly.

Replacing the hemolyzer

1 Remove the top cover, the printer cover and the T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

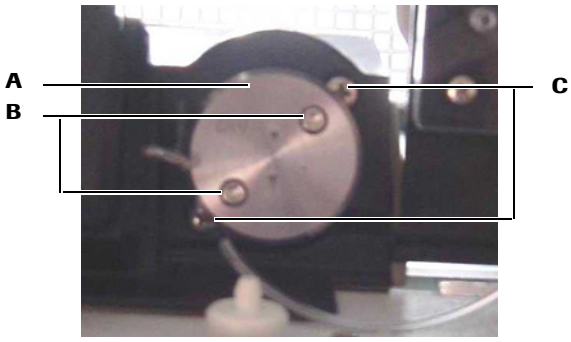
Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect the hemolyzer plug from the HSIN board.

7 Unscrew the two screws (internal hex) holding the hemolyzer head and remove it.



A Hemolyzer
B Two screws holding the hemolyzer head
C Two screws holding the hemolyzer

Figure B-43 Hemolyzer

8 Unscrew the two screws (see above, C) holding the hemolyzer and pull it out to the back.

Use the reverse order for assembly.

When installing the hemolyzer head tighten the two screws alternately to prevent distortion!
Do not reverse the two tubes on the hemolyzer when reconnecting them!

Replacing the Hemolyzer tube

1 Remove the **cobas b** 221 system top cover.

2 Disconnect the tube on the hemolyzer (out) and at the cuvette input and remove it.

Use the reverse order for assembly.

Replacing the HSIN board

Electrostatically sensitive components!

1 Remove the top cover, the printer cover and the T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

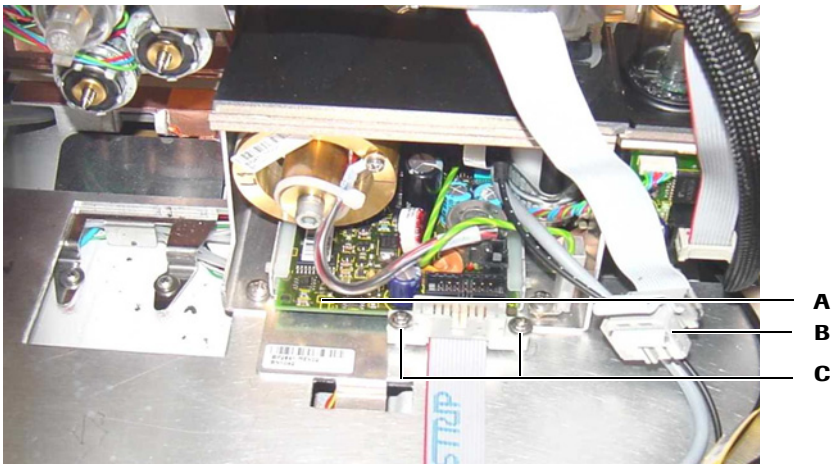
Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect the wide plug and the hemolyzer plug from the HSIN board.

7 Disconnect the flat cable from the HSIN board.



A HSIN board
B Actuator bus cable plug
C Two mating component screws

Figure B-44 Hemolyzer - HSIN board

8 Remove the plug from the actuator board and unscrew the two mating component screws (see above, B).

9 Pull the HSIN board out to the back and remove it.

Use the reverse order for assembly.

tHb/SO_2 module (cobas b 221<1/3/5> systems only)

Replacing the tHb/SO_2 module

Don't use a tHb/SO_2 module with revision 02 with a software version < 3.00.
For software version < 3.00 use a tHb/SO_2 module with revision 00 or revision 01.
These revisions are also compatible with software versions ≥ 3.00!

1 Remove the top cover, T&D cover and printer cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect the tube connector from the tHb/SO_2 module.

7 Unscrew the two screws of the left tube connecting piece and keep them for later installation of the new tHb/SO_2 module.

8 Disconnect the connector cable from the the tHb/SO_2 module from mainboard.

9 Unscrew the two screws holding the tHb/SO_2 module.

10 Pull the tHb/SO_2 module forward and remove it.

Use the reverse order for assembly.

Replacing the tubing set tHb/PolyOX

Activate the function program ☞ [System] > [Utilities] > [Maintenance] > [Change Hb cartridge] to position all valve actuators correctly.

1 Remove the top cover.

2 Disconnect the left tube from the cuvette holder.

👁 For details, see Figure B-41 on page B-58.

3 Disconnect the connector tube to V4 on the T-piece and remove tubing set tHb/PolyOX..

👁 For details, see Figure B-41 on page B-58.

Use the reverse order for assembly.

Replacing the tHb/SO_2 heating unit

1 Disconnect the tHb/SO_2 module.

👁 For instructions, see *Replacing the tHb/SO_2 module* on page B-62.

2 Disconnect and remove the heating unit.

Use the reverse order for assembly.

When assembling the tHb/SO_2 heating unit, make sure it is placed correctly in order to avoid possible damage.

Replacing the Hb cartridge

Activate the function program ☞ [System] > [Utilities] > [Maintenance] > [Change Hb cartridge] to position all valve actuators correctly.

1 Remove the top cover and T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

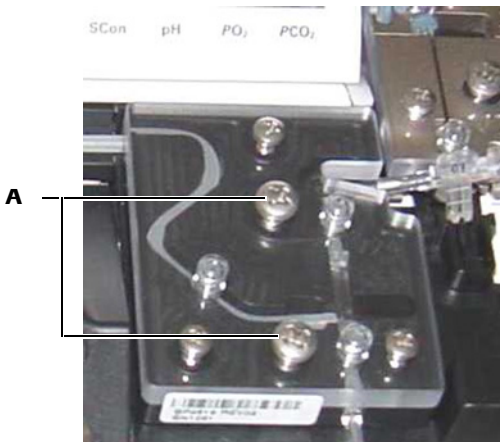
For details, see Figure B-4 on page B-22.

3 Slide the bypass holder down and fold the bypass nipple up.

For details, see Figure B-8 on page B-25.

4 Disconnect the bypass nipple, the connector tube to the tHb/SO_2 module (or hemolyzer) and the waste tube (on the waste separator).

5 Unscrew the two screws holding the Hb cartridge and remove the cartridge (see below).



A Two screws holding the Hb cartridge

Figure B-45 Hb cartridge

Use the reverse order for assembly.

Peristaltic pumps (PP)

Replacing a peristaltic pump

1 Switch off the **cobas b** 221 system.

Please pay attention to *Shutdown* on page B-19.

2 Remove the top cover and printer cover of the **cobas b** 221 system.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

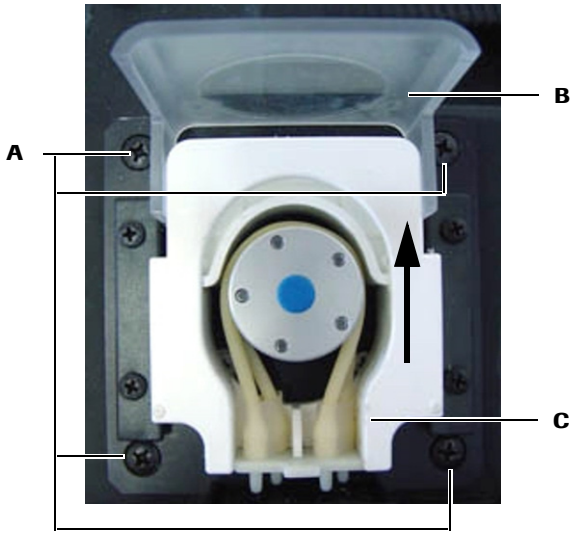
The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Disassemble the fan shield.

For instructions, see *Replacing the main fan unit* on page B-110.

8 Remove the plug on the back of the pump.

9 Open the locking lever (Plexiglas cover) of the peristaltic pump and slide the linear clamp (white plastic part) up (see below).



A Four screws holding the peristaltic pump **C** Linear clamp
B Locking lever

Figure B-46 Peristaltic pump

10 Remove the pump tube.

11 Unscrew the four screws holding the peristaltic pump, slide it up and pull it out forwards (see above, A).

Use the reverse order for assembly.

When positioning the pump tube around the pump head, make sure that the tubes are not crossed.

Test the function of the peristaltic pump with ☞ [System] > [Component test] > [Aggregates] > [Peristaltic pumps].

Replacing the pump head

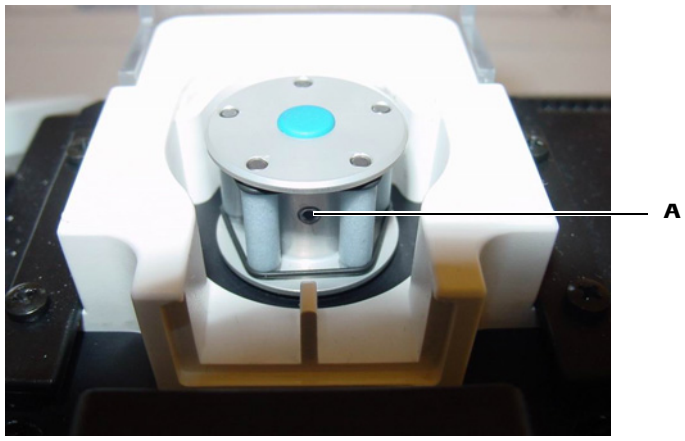
1 Remove the **cobas b** 221 system top cover.

2 Open the locking lever (Plexiglas cover) of the peristaltic pump and slide the linear clamp (white plastic part) up.

For details, see Figure B-46 on page B-65.

3 Remove the pump tube.

4 Loosen the setscrew on the pump head with a 1.5 mm Allen wrench.

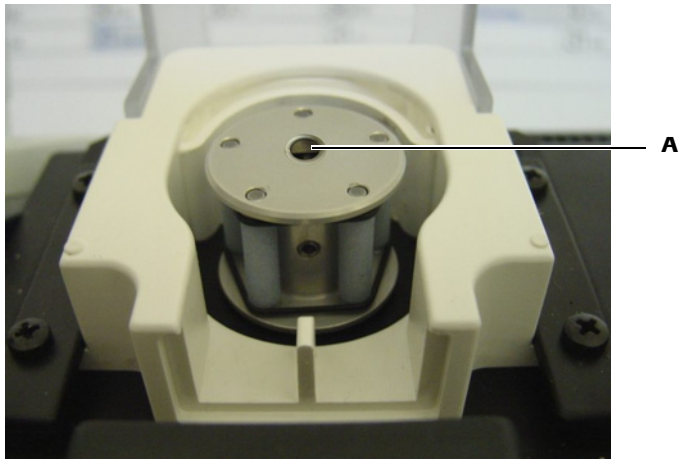


A Setscrew

Figure B-47 Pump head

5 Pull the pump head up.

6 Connect the new pump head and fasten it with the setscrew. Note that the setscrew must grip the flat side of the shaft (remove blue cap).



A Flat side of shaft

Figure B-48 Pump head shaft

7 Position the pump tube around the pump head. Note that the tubes must not be crossed.

The remaining assembly is done in reverse order.

Replacing the pump tube

1 Remove the **cobas b** 221 system top cover.

2 Open the locking lever (Plexiglas cover) of the peristaltic pump and slide the linear clamp (white plastic part) up.

For details, see Figure B-46 on page B-65.

3 Remove the old pump tube.

4 Position the new pump tube around the pump head in the correct way. Note that the tubes must not be crossed.

The remaining assembly is done in reverse order.

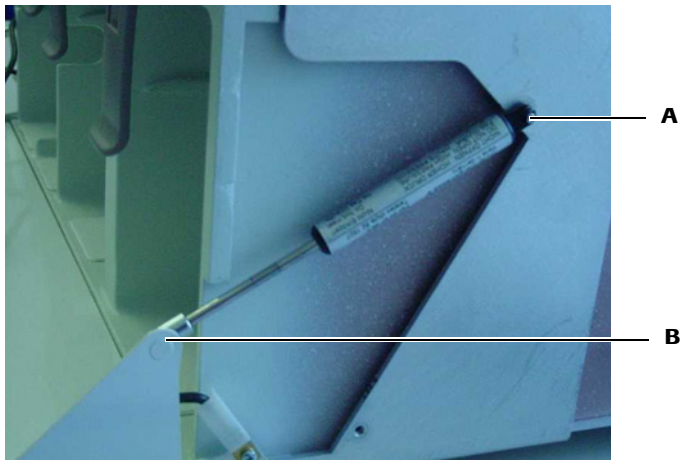
Bottle compartment

Replacing the bottle compartment cover

1 Open the bottle compartment cover.

2 Disconnect the two cables (left and right).

3 Lift the two front fork heads of the gas dampers (left and right) from the retaining pins of the bottle compartment cover with a screwdriver (see below).



A Back fork head **B** Front fork head

Figure B-49 Gas damper

4 Remove the bottle compartment cover.

Use the reverse order for assembly.

Replacing the gas dampers

1 Open the bottle compartment cover.

2 *Left gas damper*:
unscrew the five screws holding the left side panel of the **cobas b** 221 system and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

Right gas damper:
unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

3 Lift the front fork head of the respective gas damper from the retaining pin of the bottle compartment cover with a screwdriver.

For details, see Figure B-49 on page B-67.

4 Lift the back fork head of the respective gas damper from the retaining pin of the **cobas b** 221 system instrument frame with a screwdriver.

For details, see Figure B-49 on page B-67.

5 Remove the respective gas damper.

Use the reverse order for assembly.

Replacing the waste separator

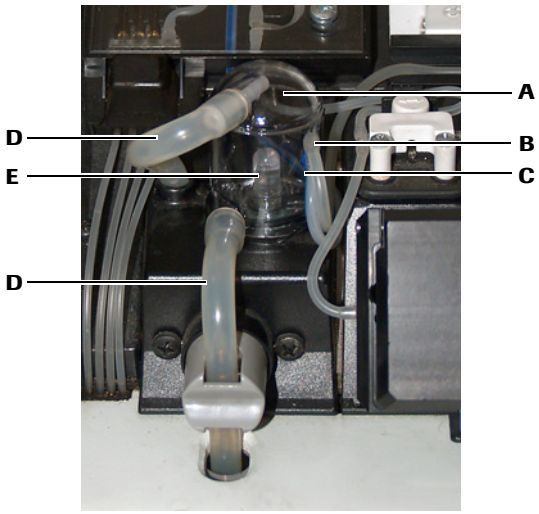
*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Remove the **cobas b** 221 system top cover.

2 Disconnect all tubes from the waste separator.



A Waste separator
B Bypass tube
C Tube connection from the measuring chamber cartridge
D Waste tube
E Waste sensor

Figure B-50 Waste separator

3 Rotate the waste separator about a quarter turn counterclockwise and remove it.

4 Remove the waste sensor from the waste separator.

When removing the sensor make sure that the light guide is not bent.

Use the reverse order for assembly.

Replacing the waste docking mechanism

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

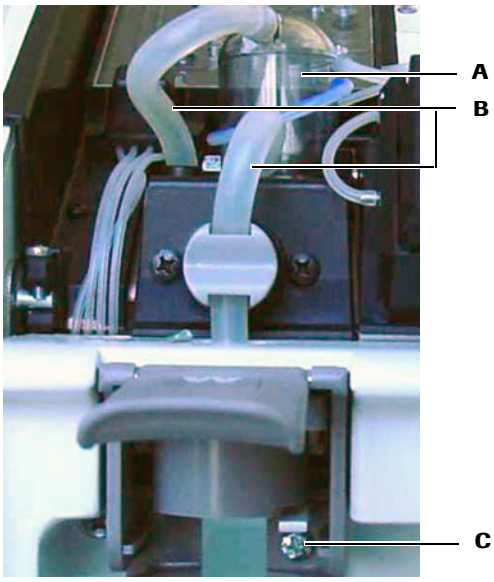
1 Remove the **cobas b** 221 system top cover.

2 Open the bottle compartment cover and the waste docking mechanism.

3 Pull the waste container out to the front.

4 Pull the waste tube off the waste separator (see below).

5 Unscrew the screw holding the waste docking mechanism (see below).



A Waste separator
B Waste tube
C Holding screw

Figure B-51 Waste docking mechanism

6 Pull the waste docking mechanism 1 cm forward and then pull it down.

7 Pull the waste tube out of the waste docking mechanism.

Use the reverse order for assembly.

Replacing the docking mechanism S1 (rinse solution)

1 Remove the **cobas b** 221 system top cover.

2 Open the bottle compartment cover and the S1 docking mechanism.

3 Pull S1 rinse solution forward.

4 Unscrew the screw holding the S1 docking mechanism.

5 Pull the S1 docking mechanism 1 cm forward and then pull it down.

6 Pull the rinse tube off the nipple and remove the S1 docking mechanism.

Use the reverse order for assembly.

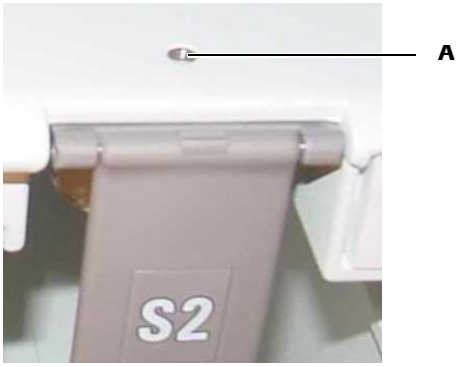
Replacing the docking mechanisms S2 and S3 (fluid packs)

1 Remove the top cover and T&D cover of the **cobas b** 221 system.

2 Open bottle compartment cover and S2 (or S3) docking mechanism.

3 Pull S2 (or S3) fluid pack forward.

4 Unscrew the screw holding the S2 (or S3) docking mechanism.



A Holding screw

Figure B-52 S2/S3 docking mechanism

5 Remove the label clip from the handle of the S2 (or S3) docking mechanism and pull the docking mechanism out.

6 Disconnect the tube connector and remove the S2 (or S3) docking mechanism.

Use the reverse order for assembly.

Make sure that the tube connector is in the correct position during installation!

Replacing the clamp docking mechanism

1 Open the bottle compartment cover.

2 Open the docking mechanism Waste or S1 Rinse Solution.

3 Remove the respective bottle.

4 Open the mounting screw of the respective docking mechanism.

For details, see Figure B-51 on page B-70.

5 Pull out the respective docking mechanism to the front.

6 Move the clamp docking mechanism backwards out of the respective docking mechanism. Therefore a certain amount of force is needed.

Assembly is done in reverse order.

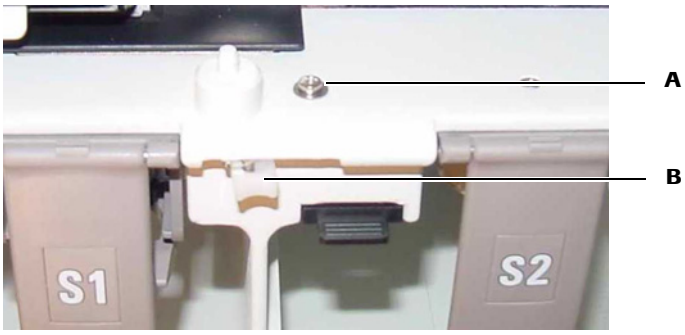
Check the tube connections after the assembly!

Replacing the micro switch module

1 Remove the **cobas b** 221 system top cover.

2 Open the bottle compartment cover.

3 Unscrew the screw holding the micro switch module.



A Holding screw **B** Micro switch

Figure B-53 Micro switch

4 Pull micro switch module forward.

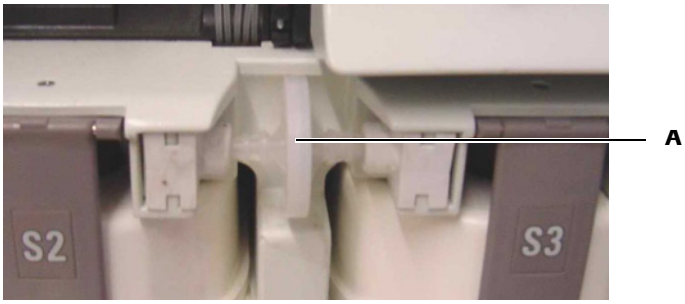
5 Disconnect the two plug connectors and remove the micro switch module.

Use the reverse order for assembly.

Replacing the bacteria filter

1 Open the bottle compartment cover.

2 Slide the bacteria filter left or right and pull it forward.



A Bacteria filter

Figure B-54 Bacteria filter

Use the reverse order for assembly.

Install the bacteria filter with the "Inlet" label pointing to the left.

Replacing the Transponder Control (waste, S1, S2, S3)

1 Remove the rear panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

2 Pull the AutoQC drawer out and remove the ampoule block.

3 *For S1 Rinse Solution only*:
Close AutoQC drawer and unscrew the two screws holding the transponder control cover plate.

4 *For S3 Fluid Pack transponder control only*:
Pull the waste exhaust tube from the guide; unscrew the two screws holding the plug shield of the FMS control board and remove the plug shield; unscrew the two screws holding the FMS control board and slide the board to the side.

For details of removing the plug shield, see Figure B-19 on page B-33.

5 Disconnect the cable from the transponder control.

6 Unscrew the screw holding the transponder control and remove the transponder control.

Use the reverse order for assembly.

Vacuum system

Replacing the vacuum pump completely

Various components of the ***cobas b*** *221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Switch off the **cobas b** 221 system and open the bottle compartment cover.

2 Remove the top cover and T&D cover of the **cobas b** 221 system.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

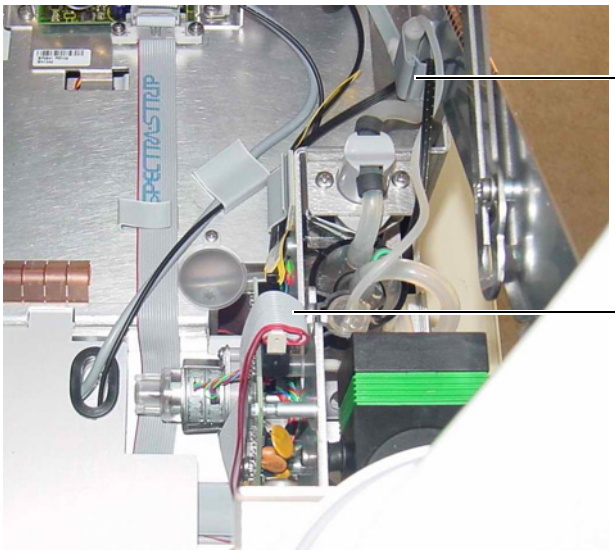
6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Unscrew the five screws holding the left side panel of the **cobas b** 221 system and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

8 Disconnect the actuator bus cable from the vacuum pump.

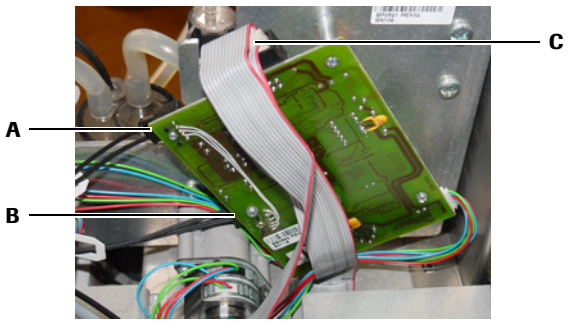


A Cable clip **B** Actuator bus cable

Figure B-55 Vacuum pump - actuator bus cable

9 Hold down the lock button of the waste sensor plug and pull it out.

For details on the lock button, see Figure B-68 *Sample sensor board* on page B-91.

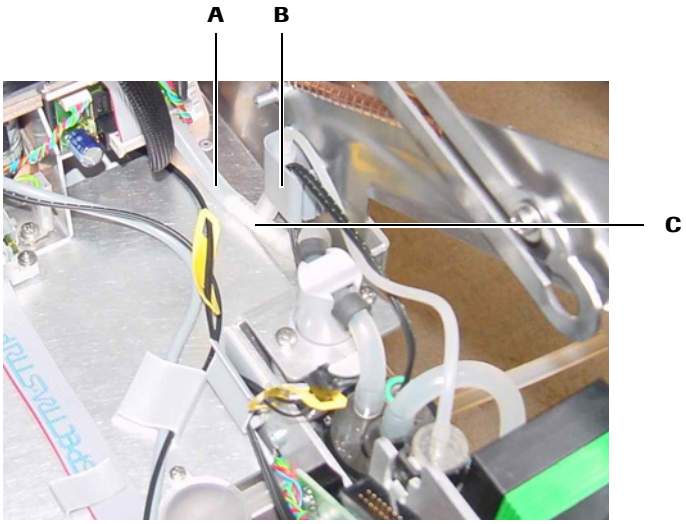


A VPP sensor cable plug **C** Actuator bus cable
B Waste sensor cable plug

Figure B-56 Vacuum pump – cabling

10 Disconnect the exhaust tube.

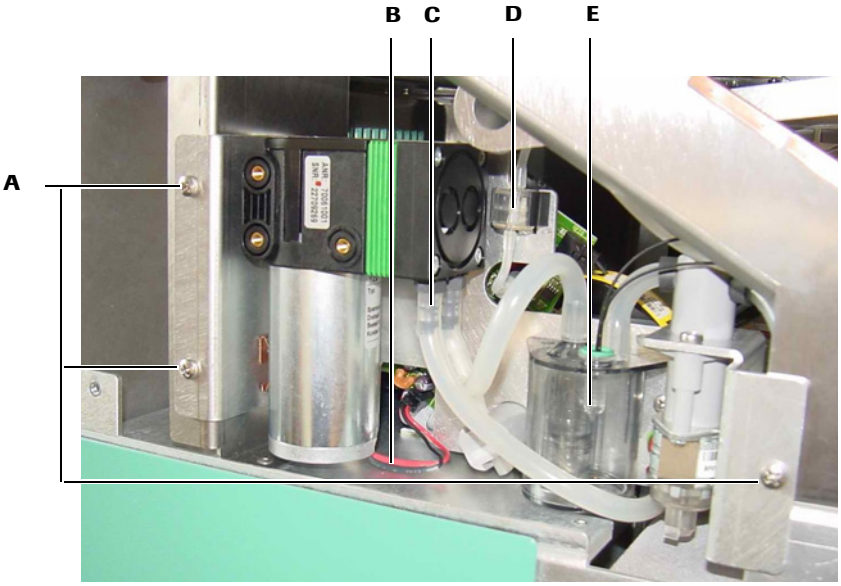
11 Open the cable clip and disconnect the waste tube (see below, A) at the T-piece and slide it out.



A Waste tube
B Cable clip
C T-piece

Figure B-57 Waste tube

12 Unscrew the three screws holding the vacuum pump (see below, A) and remove the vacuum pump.



A Three screws holding the vacuum pump
B Pump motor cable
C Exhaust tube
D Moisture trap
E VPP sensor

Figure B-58 Vacuum pump

Use the reverse order for assembly.

Replacing the vacuum pump

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Remove the vacuum pump completely.

👁 For instructions, see *Replacing the vacuum pump completely* on page B-73.

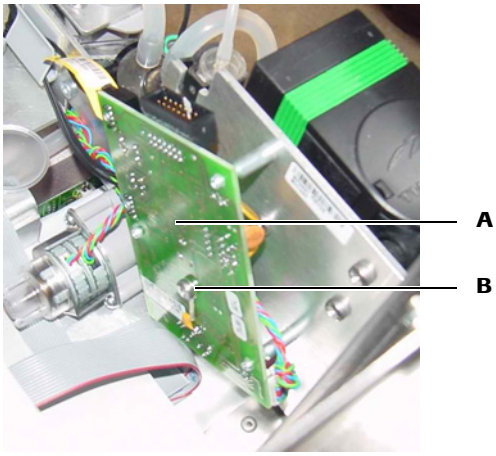
2 Disconnect the waste tube on the inlet side of the pump unit.

👁 For details, see Figure B-58 on page B-75.

3 Disconnect the pump motor cable from the vacuum control board.

👁 For details, see Figure B-58 on page B-75.

4 Unscrew the screw holding the vacuum control board and slide it to the side.



A Vacuum control board **B** Holding screw

Figure B-59 Vacuum control board

5 Unscrew the three screws holding the pump unit and remove it.

6 Unscrew the three low-frequency bearings of the pump unit and fasten them to the new pump unit.

The remaining assembly is done in reverse order.

Replacing the moisture trap

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Unscrew the five screws holding the left side panel of the **cobas b** 221 system and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

2 Pull the moisture trap from the holder and disconnect the two tubes.

For details, see Figure B-58 on page B-75.

3 Remove the moisture trap.

Use the reverse order for assembly.

Replacing the waste tube

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Remove the waste docking mechanism.

For instructions, see *Replacing the waste docking mechanism* on page B-69.

2 Pull the waste tube from the waste docking mechanism and remove it.

Use the reverse order for assembly.

Replacing the vacuum pump protector

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Unscrew the five screws holding the left side panel of the **cobas b** 221 system and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

2 Disconnect the two tubes and the sensor on the vacuum pump protector.

For details, see Figure B-58 on page B-75.

3 Loosen the two screws holding the vacuum pump protector by unscrewing them out about 1 cm.

4 Pull the vacuum pump protector up and remove it.

Use the reverse order for assembly.

Replacing the VP tube set

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

1 Switch off **cobas b** 221 system and open bottle compartment cover.

2 Remove the top cover and T&D cover of the **cobas b** 221 system.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Unscrew the five screws holding the left side panel of the **cobas b** 221 system and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

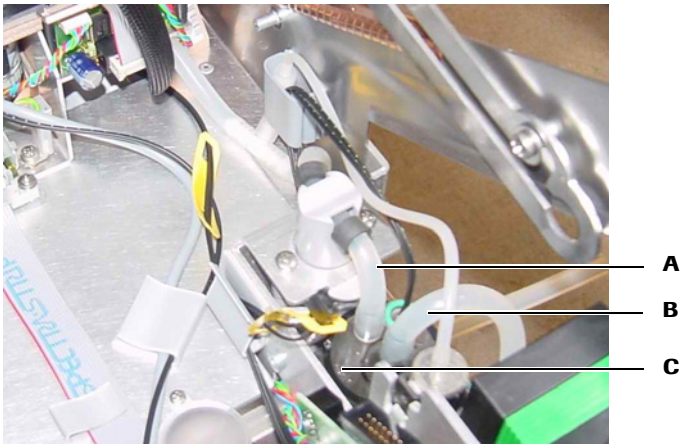
8 For this purpose, record the barcode located on the polychromator bilirubin!

For details, see Figure B-51 on page B-70.

9 Open the cable clamp, disconnect the waste tube at the T piece, and unthread it.

For details, see Figure B-57 on page B-75.

10 Disconnect the waste tube at the vacuum pump protector and remove it.



A Waste Tube
B Air tube
C Vacuum pump protector

Figure B-60 VP tube set

11 Disconnect the air tube at the vacuum pump protector and at the vacuum pump and remove it.

Use the reverse order for assembly.

Replacing the vacuum control board

Electrostatically sensitive components!

1 Remove the top cover and T&D cover of the **cobas b** 221 system.
2 Rotate the T&D lock on the T&D module 90 degrees to the right.
For details, see Figure B-4 on page B-22.
3 Carefully pull the sample inlet path out to the right and remove it.
4 Unscrew the three screws holding the central measuring unit.
For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Remove all connectors from the vacuum control board.
7 Unscrew the screw holding the vacuum control board and remove it.
For details, see Figure B-59 on page B-76.

Use the reverse order for assembly.

Replacing the Actuator Board V4/V6

1 Remove top cover and T&D cover.
2 Rotate the T&D lock on the T&D module 90 degrees to the right.
For details, see Figure B-4 on page B-22.
3 Carefully pull the sample inlet path out to the right and remove it.
4 Unscrew the three screws holding the central measuring unit.
For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect the connectors from the V4/V6 actuator board.

7 Unscrew the screw holding the V4/V6 actuator board and remove the board.

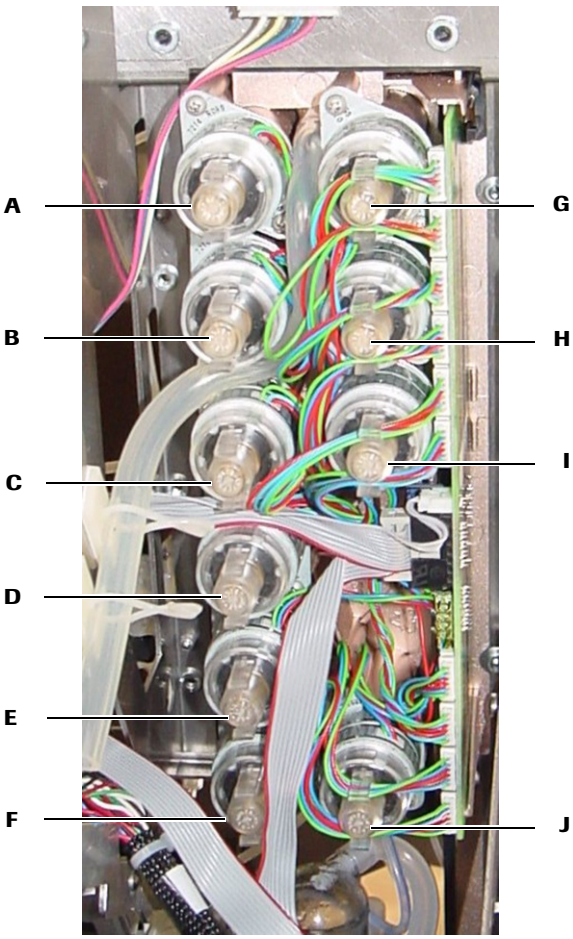
Use the reverse order for assembly.

Valves

Replacing the valves of the measuring chamber cartridge

These instructions apply to the following valves:

V3, V5, V8, V9, V12, V14, V16, V17, VIO, VBO



A V12
B V8
C V9
D VIO
E V5
F VBO
G V17
H V16
I V14
J V3

Figure B-61 Valves of the measuring chamber cartridge

1 Switch off the **cobas b** 221 system.

👁 Please pay attention to *Shutdown* on page B-19.

2 Remove the top cover and T&D cover of the **cobas b** 221 system.

3 Rotate the T&D lock on the T&D module 90 degrees to the right

👁 For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

👁 For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Disconnect the valve cable from the slot.

8 Unscrew the two screws holding the respective valve.

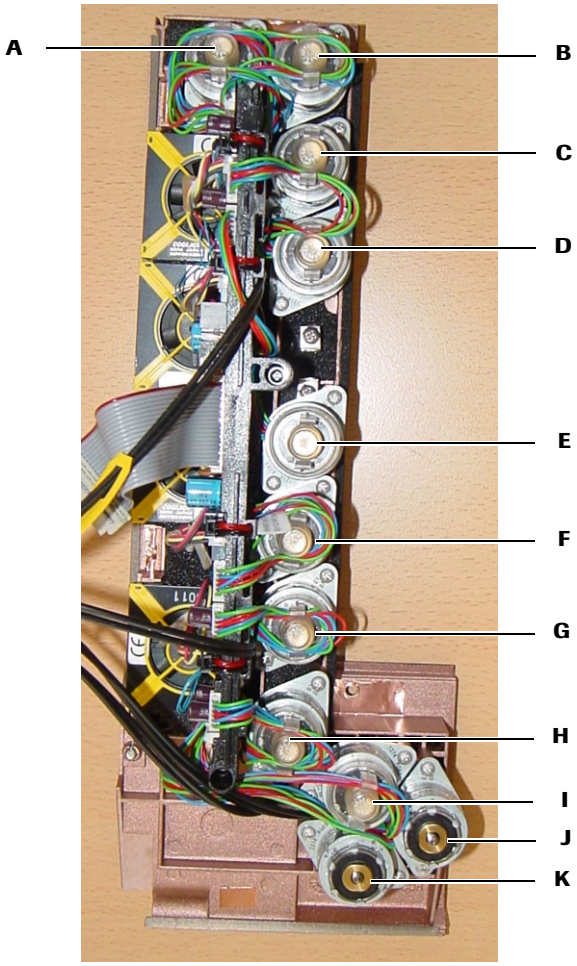
9 Pull the valve back and remove it.

Use the reverse order for assembly.

Replacing the valves from sample distributor cartridge and Hb cartridge

These instructions apply to the following valves:

V10, V15, V20, V21, V22, VBI, VII, VSI, V2, V23, V24



A V10
B V15
C V20
D VSI
E VII
F V21
G VBI
H V22
I V24
J V23
K V2

Figure B-62 Sample distributor valves and Hb cartridge valves

1 Switch off the **cobas b** 221 system.

👁 Please pay attention to *Shutdown* on page B-19.

2 Remove the **cobas b** 221 system top cover.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

👁 For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Unscrew the two screws holding the mainboard retainer.

For details, see Figure B-66 on page B-89.

8 Fold the mainboard retainer down.

9 Disassemble the fan shield.

For instructions, see *Replacing the main fan unit* on page B-110.

10 Disconnect the valve bus cable of the respective valve from the slot.

11 Unscrew the two screws holding the respective valve.

12 Pull the valve back and remove it.

13 Insert the valve spindle of the new valve manually.

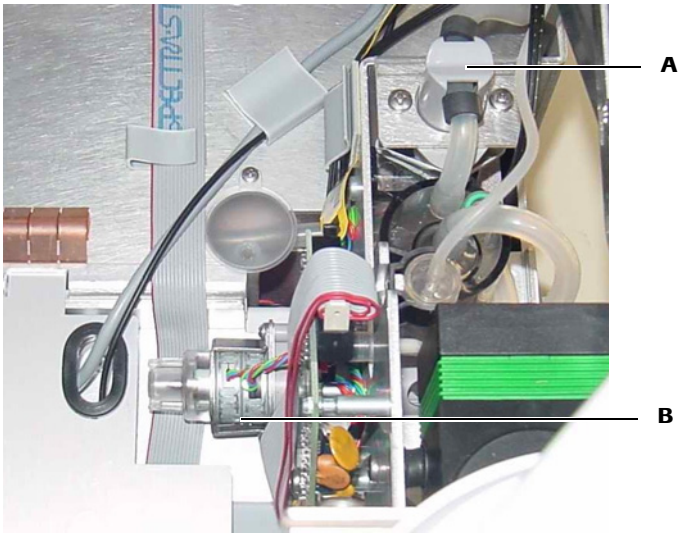
Use the reverse order for assembly.

Replacing the waste valves V13/V18

V13 and V18 are different parts:

V13 = valve undamped

V18 = VP waste valve



A V18 (VP waste valve) **B** V13 (valve undamped)

Figure B-63 Waste valves V13 and V18

1. Remove the vacuum pump completely.

   For instructions, see *Replacing the vacuum pump completely* on page B-73.

2. Disconnect the two tubes on the vacuum pump protector.

   For details, see Figure B-58 on page B-75.

3. Loosen the two screws holding the vacuum pump protector by unscrewing them out about 1 cm.
4. Pull the vacuum pump protector up and remove it.
5. Pull the tube out of the waste valve V13 or V18 (see above).
6. Disconnect the power supply cable of the valve V13 or V18 on the board.
7. Unscrew the two screws holding the waste valve V13 or V18 and remove the valve.
8. Remove the MC valve centering instrument and fasten it to the new valve.

Use the reverse order for assembly.

Replacing the waste valve V6

1 Switch off the **cobas b** 221 system.

👁 Please pay attention to *Shutdown* on page B-19.

2 Disassemble the waste docking mechanism.

👁 For instructions, see *Replacing the waste docking mechanism* on page B-69.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

👁 For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

👁 For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

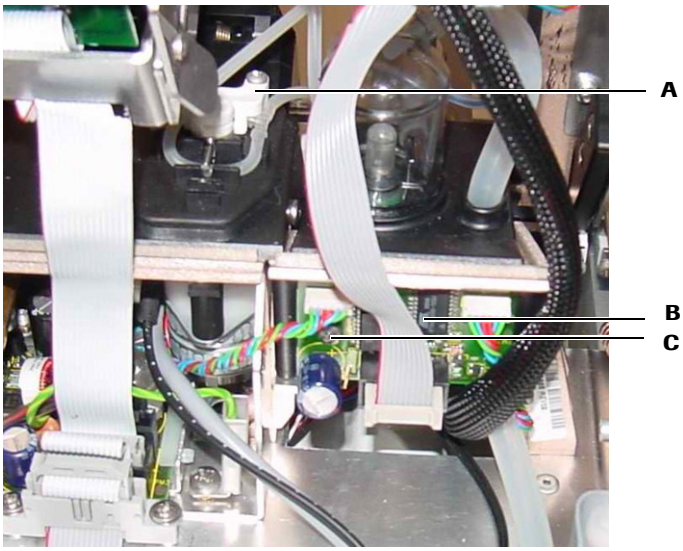
The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Unscrew the five screws holding the left side panel of the **cobas b** 221 system and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

8 Disconnect the connectors from the V4/V6 actuator board.

9 Unscrew the screw holding the V4/V6 actuator board and slide the board to the side.

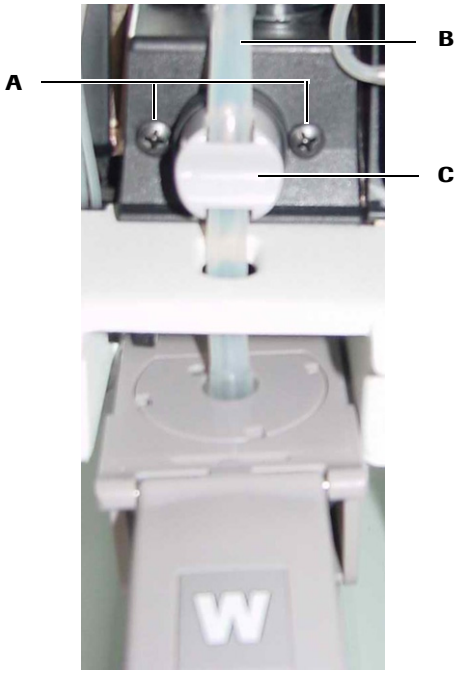


A Relief clamp
B Actuator Board V4/V6
C Holding screw

Figure B-64 Actuator board

10 Disconnect the waste tube from the waste docking mechanism and pull it out of the valve (see below).

11 Unscrew the two screws holding the V6 waste valve (see below, A).



A Two screws holding the V6 waste valve
B Waste tubing
C V6

Figure B-65 Waste valve V6

12 Pull the V6 waste valve back and remove it.

Use the reverse order for assembly.

Replacing the air valve V4

*V4 is a separate valve called "valve **cobas b** 221 system", do not use the valve called "valve unit", it is different!*

1 Switch off the **cobas b** 221 system.

👁 Please pay attention to *Shutdown* on page B-19.

2 Remove the top cover and T&D cover.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

👁 For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit.

👁 For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Disconnect cable of V4 from the V4/V6 actuator board.

8 Loosen the relief clamp and remove the tubes.

9 Carefully pry out valve V4 by using a flat-head screw driver.

Use the reverse order for assembly.

Replacing the FMS valve (MIX)

1 Disassemble the FMS unit.

👁 For instructions, see *Replacing the FMS* on page B-33.

2 Unscrew the two screws holding the MIX valve and remove the valve.

Use the reverse order for assembly.

Mainboard unit

Replacing the Mainboard unit

Electrostatically sensitive components!

1 Switch off the **cobas b** 221 system.

👁 Please pay attention to *Shutdown* on page B-19.

2 Remove the top cover and T&D cover of the **cobas b** 221 system.

3 Rotate the T&D lock on the T&D module 90 degrees to the right.

👁 For details, see Figure B-4 on page B-22.

4 Carefully pull the sample inlet path out to the right and remove it.

5 Unscrew the three screws holding the central measuring unit

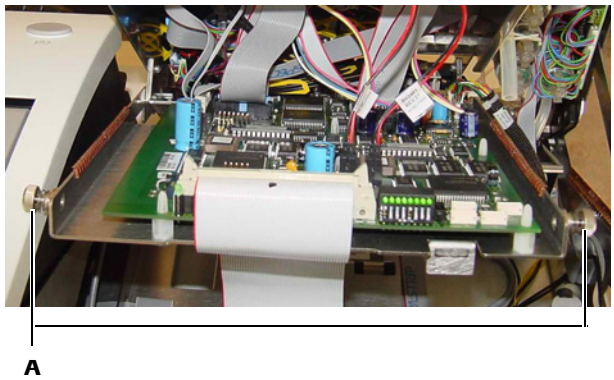
👁 For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

6 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

7 Unscrew the two screws holding the mainboard unit (see below).



A Two screws holding the mainboard unit

Figure B-66 Mainboard unit

8 Fold the mainboard unit down.

9 Remove all plug connectors on the mainboard.

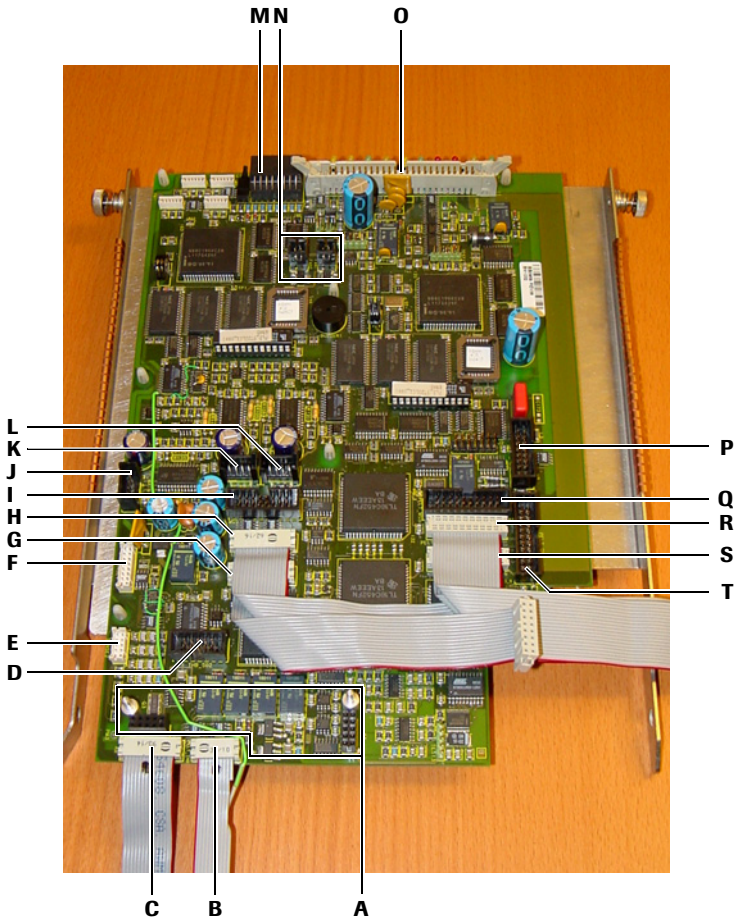
10 Disconnect all cable connectors fixed to the mainboard with plugs on the modules.

The BG and ISE module plug connectors on the mainboard are permanently attached: do not pull them off!

11 Press the mainboard unit to the left or right to release it from the retainer pins.

12 Remove the mainboard unit.

Use the reverse order for assembly.



A	Sample sensor board	**H**	Measuring chamber ISE	**O**	Interface unit
B	Peltier tHb/SO_2–COOX	**I**	Measuring chamber MSS	**P**	Valve bus
C	Actuator bus HS	**J**	PP main	**Q**	Peltier MSS
D	tHb/SO_2–COOX	**K**	PP MSS out	**R**	Peltier ISE
E	Sense 2	**L**	PP MSS in	**S**	Peltier BG
F	Sense 1	**M**	DIP switch	**T**	Peltier SD
G	Measuring chamber BG	**N**	Fan 1 / fan 2		

Figure B-67 Mainboard connectors

The default settings for all items of the DIP switch are "Off".

Replacing the sample sensor board

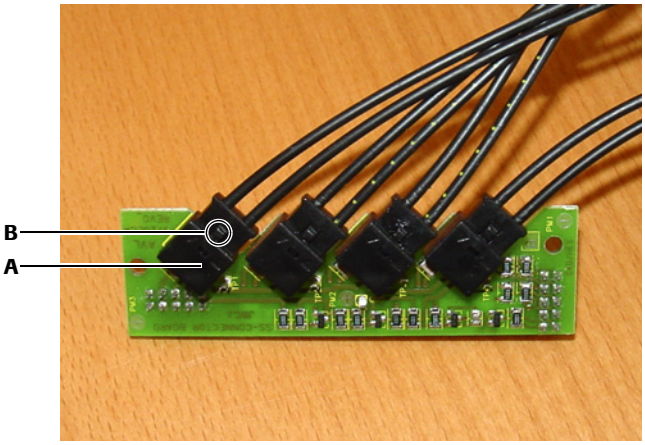
Electrostatically sensitive components!

1 Follow section *Replacing the Mainboard unit* until step 8.

For instructions, see steps 1 to 8 of *Replacing the Mainboard unit* on page B-89.

2 Carefully unplug the sample sensor board from the mainboard.

3 Unplug the sample sensor cable by pressing the release button and pulling the sample sensor cable plug.



A Plug socket **B** Release button (on sample sensor cable plug)

Figure B-68 Sample sensor board

Use the reverse order for assembly.

Note the sample sensor board labeling when attaching the light guides to the sample sensor board.

Interface unit

Compatibility chart

When replacing the touch screen/PC unit, the interface unit or the hard disk, follow the compatibility chart.

For details, see Figure B-69 *Touch screen/PC unit, interface unit and hard disk compatibility* on page B-92.

	Roche *OMNI S* system SN < 1500 (not upgraded)	Roche *OMNI S* system 1500 < SN < 3000	**cobas b** 221 system SN > 3000
TS-PC UNIT COMPLETE	x (1)		
TS-PC UNIT 3.X > SN 1500		**x** (2)	
TS-PC UNIT 4.X > SN 3000	**x** (3)	**x** (3)	**x**
TS-PC UNIT 3.X < SN 1500 (UPGRADE KIT)	**x** (2)		
TS-PC UNIT 4.X < SN 3000 (UPGRADE KIT)	**x**	**x**	
HARD DISK CONFIGURED	**x** (4)		
HARD DISK CONFIGURED 3.X		x (5)	
HARD DISK CONFIGURED 4.X		**x**	**x**
RECHARGEABLE BATTERY + CONTROL ELECTRONIC	**x** (4)		
RECHARGEABLE BATTERY + CONTROL ELECTRONIC 3.X		**x**	**x**
FLOPPY DISK DRIVE 3,5", 1,44 MB	**x**	**x**	**x**
INTERFACE UNIT OMNI S	**x** (4)		
INTERFACE UNIT OMNI S > SN 1500		x (6)	
INTERFACE UNIT **COBAS B** 221 > SN 3000		**x**	**x**

1 ... Not available any more
2 ... Replaced by 05092469001 TS-PC UNIT 4.X < SN 3000 (UPGRADE KIT)
3 ... May only be used together with 04736125001 INTERFACE UNIT **COBAS B** 221 > SN 3000
4 ... May only be used together with 03313476001 TS-PC UNIT COMPLETE
5 ... Replaced by 05092400001 HARD DISK CONFIGURED 4.X
6 ... Replaced by 04736125001 INTERFACE UNIT **COBAS B** 221 > SN 3000

Rev. 4.X production parts and spare parts are labeled with a green dot (sticker)

Figure B-69 Touch screen/PC unit, interface unit and hard disk compatibility

Replacing the Interface unit

Electrostatically sensitive components!

1 Remove the rear panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

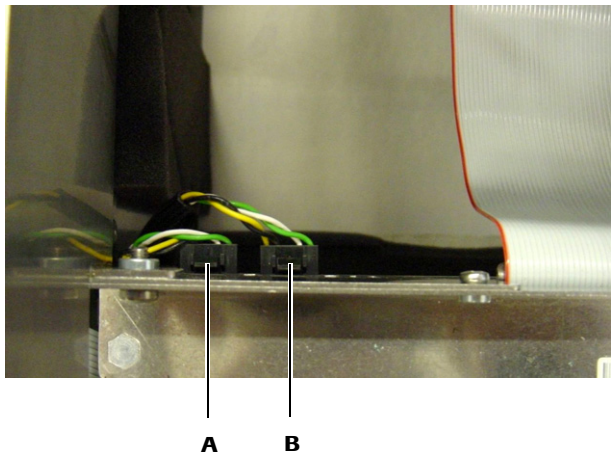
For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect the connector cable of the AutoQC module and the COOX module at the interface board.



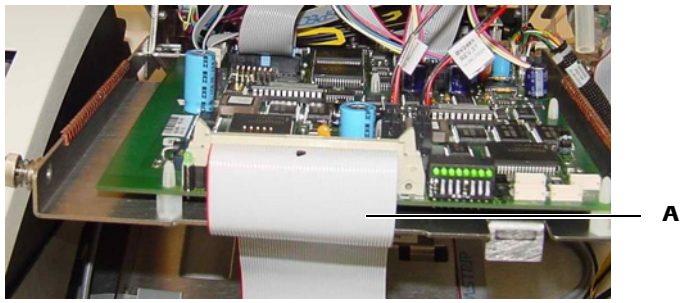
A AutoQC module connector cable **B** COOX module connector cable

Figure B-70 Interface connections

7 Disconnect the screen cable on the left interior of the interface unit.

For details, see Figure B-80 on page B-103.

8 Disconnect the interface unit connector cable on the mainboard.



A Interface unit connector cable

Figure B-71 Interface unit connector cable

9 Disassemble the printer.

For instructions, see *Replacing the Printer* on page B-108.

10 Unscrew the four screws holding the interface unit (see below).

A Four screws holding the interface unit

Figure B-72 Interface unit

Grasp the interface unit while unscrewing the mounting screws to prevent it from sliding off!

11 Pull the interface unit to the back and remove it.

Use the reverse order for assembly.

During installation, ensure that the cable connections and the orientation of the printer connection cable are correct!

For details, see Figure B-82 on page B-109.

Replacing the AutoQC/COOX cable

1 Remove the rear panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disconnect the respective cable on the interface unit.

For details, see Figure B-70 on page B-93.

7 *For AutoQC cable only: remove the AutoQC drawer*;
open the bayonet closure of the primary light guide connector and remove it;
unscrew the two screws holding the light guide conduit and pull the light guide conduit out through the back.

For details, see Figure B-40 on page B-57.

8 Disconnect the cables on the COOX and AutoQC control board, pull them out and remove them.

Use the reverse order for assembly.

During installation, ensure that the cable connections are correct!

Touch screen/PC unit

Compatibility chart

When replacing the touch screen/PC unit, the interface unit or the hard disk, follow the compatibility chart.

For details, see Figure B-69 *Touch screen/PC unit, interface unit and hard disk compatibility* on page B-92.

Replacing the touch screen/PC unit

- *Before replacing the touch screen/PC unit, all data must be backed up!*
- *The settings data can be imported and exported.*
- *After replacing the touch screen/PC unit, a code must be entered in the protective settings (**cobas b** 221<2/4/6> systems only)!*
  For this purpose, record the 16 digit code located on the polychromator bilirubin!

For more information, see:
COOX module (cobas b 221<2/4/6> systems only) on page B-10
Figure B-73 on page B-96

Back up the system data or perform "System backup / restore" before replacing the touch screen/PC unit. In case of using system backup, continue at step 5, the further settings starting from page B-97 are not necessary in this case.

For more information, see *System backup / restore* on page B-11.

► Back up system data

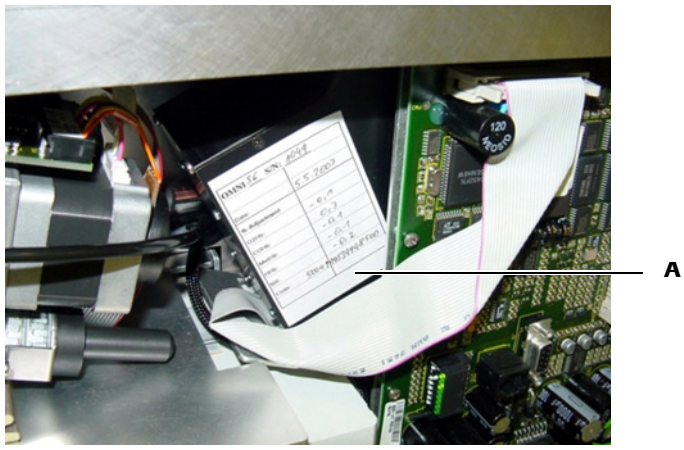
1. Export the Setup data: [Setup] > [Load / save setup] > [Export].
2. Print the Status report:
   [Info] > [Miscellaneous reports] > [Status report] > [Print status report].
3. Backup all databases:
   [Data manager] > [Utilities] > [Backup / Restore] > [Backup now]

   For more information, refer to the **cobas b** 221 system *Reference Manual, Section "Utilities"*.
4. Mark the last entry in the Backup/Restore list and copy it onto floppy disk

   For more information, refer to the **cobas b** 221 system *Reference Manual, Section "Utilities"*.
5. Switch off the **cobas b** 221 system.

   Please pay attention to *Shutdown* on page B-19.
6. Record the polychromator code (**cobas b** 221<2/4/6> systems only):
   - Remove the printer cover and the T&D cover.
   - Open the bottle compartment.
   - Unscrew the 4 mounting screws of the right side cover and remove it.

- Read and record the 16 digit code located on the polychromator bilirubin (see below).



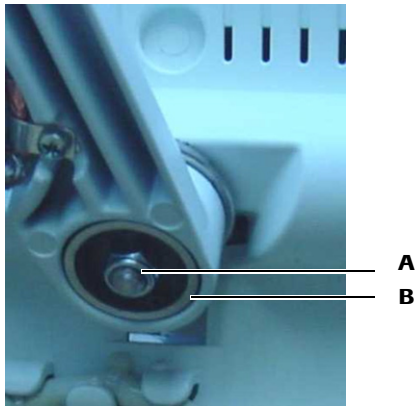
A 16 digit code

Figure B-73 Polychromator bilirubin – code

- Reassemble the right side cover, the T&D cover and the printer cover. Close the bottle compartment.

7 Disconnect the connector cable on the touch screen/PC unit and slide it out.

8 Unscrew the nut fixing the touch screen/PC unit at the bottom of the swivel arm with a 13 mm wrench.



A Fixing nut **B** Brake packet

Figure B-74 Fixing the touch screen/PC unit

9 Remove the brake packet.

10 Remove the touch screen/PC unit.

Use the reverse order for assembly.

The following settings must be performed after replacing the touch screen/PC unit, except when using "System backup / restore":

For cobas b 221<1/3/5> systems

- Check the software version ([Info] > [Software versions]) and perform a software update, if necessary (☞ [System] > [Utilities] > [Communication] > [SW upgrade]).
  - 👁 For more information, refer to:
    Software update on page B-104
    cobas b 221 system *Reference Manual, chapter "Software modes", section "SW upgrade"*
- Check date and time.
- Assign the instrument type and load the default setup.
  - 👁 For instructions, see *Instrument type* on page B-6.
  - ◦ In the menu [Setup] > [Protected Setup] > [Instrument type], select the instrument type.
  - ◦ Press the [Load default setup] key to load the default settings of the instrument stored on the hard disk.
  - ◦ Press the [Save and exit] key.
- Import the previously exported Setup data: [Setup] > [Load / save setup] > [Import].
- Print the Status report:

  [Info] > [Miscellaneous reports] > [Status report] > [Print status report], compare it to the previously printed report and adjust settings if necessary.
- Check the following settings and adjust if necessary:
  - ◦ [Setup] > [Interfaces]: Network, COM 1 and ASTM.
  - ◦ [Setup] > [Security]: Instrument functions, User management and Profile management.
  - ◦ [Setup] > [Parameters] > [Misc. Settings]: Activated for calibrations, Activated for measurements, QC lock, QC warning, Multirules.
  - ◦ [Setup] > [Display & Reports] > [Calibration] > [Cal. report]: Sensor report, Parameter report.
  - ◦ [Setup] > [Protected setup] > [Miscellaneous settings] > [Cal. intervals U.S.].
- Restore the backup data from the floppy disk:
  - ◦ [Data manager] > [Utilities] > [Backup / Restore] > [Copy from disk]
    - 👁 For more information, refer to **cobas b** 221 system *Reference Manual, Section "Utilities"*.
- Restore the databases:
  - ◦ [Data manager] > [Utilities] > [Backup / Restore] > [Restore archive]
    - 👁 For more information, refer to **cobas b** 221 system *Reference Manual, Section "Utilities"*.
- Reinsert the waste container, the S1 Rinse Solution bottle, the S2 Fluid Pack and the S3 Fluid Pack A (**cobas b** 221<5> system only).
- Insert a new MSS cartridge (**cobas b** 221<5> system only).
- Reread the barcodes of the electrodes or insert new electrodes.
- Check the barometer settings.
  - 👁 For instructions, see *Baro settings* on page B-5.
- Check the polarization voltage for MSS (for **cobas b** 221<5> system only) and PO_2 and re-enter the default values, if necessary.
  - 👁 For more information, see *Polarization voltages* on page B-10.

- Enter the serial number of the **cobas b** 221 system – it is located on the rear panel of the **cobas b** 221 system.

  For more information, see *Serial number* on page B-6.
- Perform the QC material setup: [Setup] > [QC material].

For cobas b 221<2/4/6> systems

- Check the software version ([Info] > [Software versions]) and perform a software update, if necessary (☞ [System] > [Utilities] > [Communication] > [SW upgrade])

  For more information, refer to:
  Software update on page B-104
  cobas b 221 system *Reference Manual, chapter "Software modes", section "SW upgrade"*.
- Check date and time.
- Assign the instrument type and load the default setup.

  For more information, see *Instrument type* on page B-6.
  - In the menu [Setup] > [Protected Setup] > [Instrument type], select the instrument type.
  - Press the [Load default setup] key to load the default settings of the instrument stored on the hard disk.
  - Press the [Save and exit] key.
- Import the previously exported Setup data: [Setup] > [Load / save setup] > [Import].
- Print the Status report:

  [Info] > [Miscellaneous reports] > [Status report] > [Print status report], compare it to the previously printed report and adjust settings if necessary.
- Check the following settings and adjust if necessary:
  - [Setup] > [Interfaces]: Network, COM 1 and ASTM.
  - [Setup] > [Security]: Instrument functions, User management and Profile management.
  - [Setup] > [Parameters] > [Misc. Settings]: Activated for calibrations, Activated for measurements, QC lock, QC warning, Multirules.
  - [Setup] > [Display & Reports] > [Calibration] > [Cal. report]: Sensor report, Parameter report.
  - [Setup] > [Protected setup] > [Miscellaneous settings] > [Cal. intervals U.S.].
- Restore the backup data from the floppy disk:

  [Data manager] > [Utilities] > [Backup / Restore] > [Copy from disk]

  For more information, refer to **cobas b** 221 system *Reference Manual, Section "Utilities"*.
- Restore the databases:

  [Data manager] > [Utilities] > [Backup / Restore] > [Restore archive]

  For more information, refer to **cobas b** 221 system *Reference Manual, Section "Utilities"*.
- Reinsert the wastewater bottle, the S1 Rinse Solution bottle, the S2 Fluid Pack and the S3 Fluid Pack (**cobas b** 221<6> system only).
- Insert a new MSS cartridge (**cobas b** 221<6> system only).
- Reread the barcodes of the electrodes or insert new electrodes.

- Check the barometer settings.
  For more information, see *Baro settings* on page B-5.
- Check the polarization voltage for MSS (for **cobas b** 221<6> system only) and PO_2 and re-enter the default values, if necessary.
  For more information, see *Polarization voltages* on page B-10.
- Restore the COOX adjustments:
  - In the menu [Setup] > [Protected Setup] > [COOX module] > [COOX adjustments], enter the previously recorded 16 digit code by means of the keyboard symbol.
    For more information, see:
    COOX module (cobas b 221<2/4/6> systems only) on page B-10
    Figure B-73 *Polychromator bilirubin – code* on page B-96
- Perform a polychromator calibration (☞ [System] > [Calibrations]).
- Perform a COOX calibration (☞ [System] > [Calibrations]).
- Enter the serial number of the **cobas b** 221 system – it is located on the rear panel of the **cobas b** 221 system.
  For more information, see *Serial number* on page B-6.
- Perform the QC material setup: [Setup] > [QC material].

Select a measurement report after loading the default setup and starting the PC. As default, the measurement report "example" will be selected, if available. If this is not available, create and select a new measurement report.

Replacing the hard disk

Compatibility chart

When replacing the touch screen/PC unit, the interface unit or the hard disk, follow the compatibility chart.

For details, see Figure B-69 *Touch screen/PC unit, interface unit and hard disk compatibility* on page B-92.

Electrostatically sensitive components!

*After replacing the hard disk, a code must be entered in the protected settings (**cobas b** 221<2/4/6> systems only).*
For this purpose, record the 16 digit code located on the polychromator bilirubin!

For more information, see:
COOX module (cobas b 221<2/4/6> systems only) on page B-10
Figure B-73 on page B-96

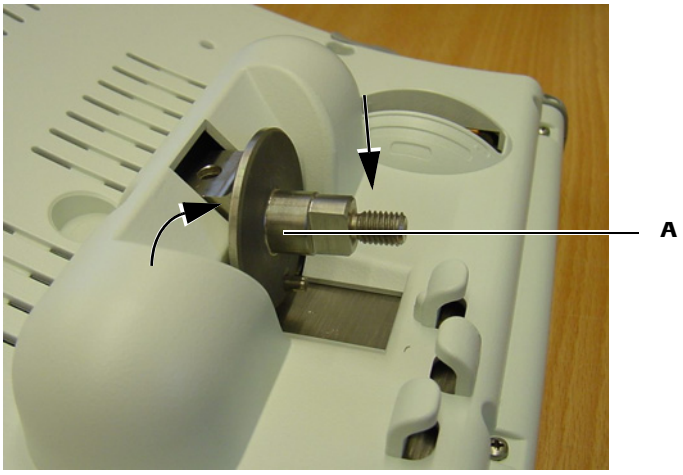
Back up the system data (see *Replacing the touch screen/PC unit* on page B-95) or perform "System backup / restore" before replacing the hard disk.

For more information, see *System backup / restore* on page B-11.

1 Disassemble the touch screen/PC unit.

For instructions, see *Replacing the touch screen/PC unit* on page B-95.

2 Push the touch screen/PC unit joint to the vertical position.



A Touch screen/PC unit joint

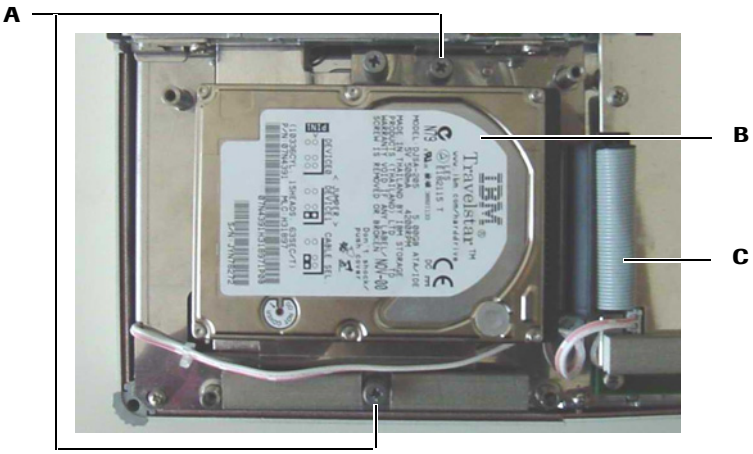
Figure B-75 Touch screen/PC unit joint

3 Unscrew the eight screws on the back of the touch screen/PC unit.

4 Remove the rear panel of the touch screen/PC unit case and disconnect the speaker cable.

For details, see Figure B-77 on page B-101.

5 Unscrew the two screws holding the hard disk.



A Two screws holding the hard disk
B Hard disk
C Connector cable

Figure B-76 Hard disk

6 Disconnect the hard disk connector cable and remove the hard disk.

Use the reverse order for assembly.

After replacing the hard disk, perform the same settings.

For instructions, see *Replacing the touch screen/PC unit* on page B-95.

Replacing the floppy disk drive

Electrostatically sensitive components!

1 Disassemble the touch screen/PC unit.

For instructions, see *Replacing the touch screen/PC unit* on page B-95.

2 Push the touch screen/PC unit joint to the vertical position.

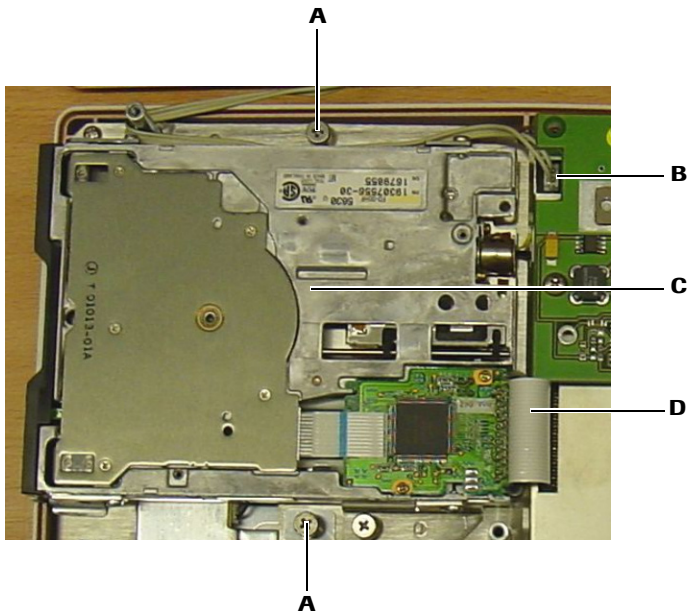
For details, see Figure B-75 on page B-100.

3 Unscrew the eight screws on the back of the touch screen/PC unit.

4 Remove the rear panel of the touch screen/PC unit case and disconnect the speaker cable.

For details, see Figure B-77 on page B-101.

5 Unscrew the two screws holding the floppy disk drive.



A Two screws holding the floppy disk drive
B Speaker cable
C Floppy disk drive
D Floppy connector cable

Figure B-77 Floppy disk drive

6 Disconnect the floppy disk drive connector cable and remove the floppy disk drive.

Use the reverse order for assembly.

Replacing the battery and charger

Electrostatically sensitive components!

1 Disassemble the touch screen/PC unit.

For instructions, see *Replacing the touch screen/PC unit* on page B-95.

2 Push the touch screen/PC unit joint to the vertical position.

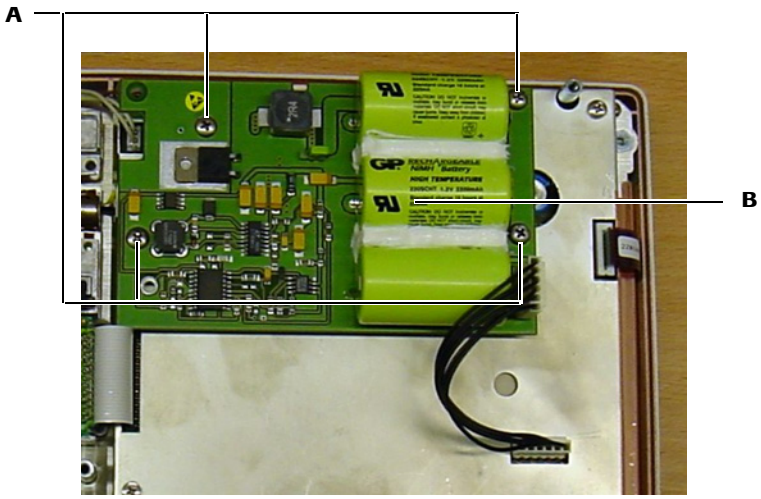
For details, see Figure B-75 on page B-100.

3 Unscrew the eight screws on the back of the touch screen/PC unit.

4 Remove the rear panel of the touch screen/PC unit case and disconnect the speaker cable.

For details, see Figure B-77 on page B-101.

5 Unscrew the four screws holding the battery and charger (be careful of the plastic washers).



A Four screws holding the battery and charger

B Battery and charger

Figure B-78 Battery and charger

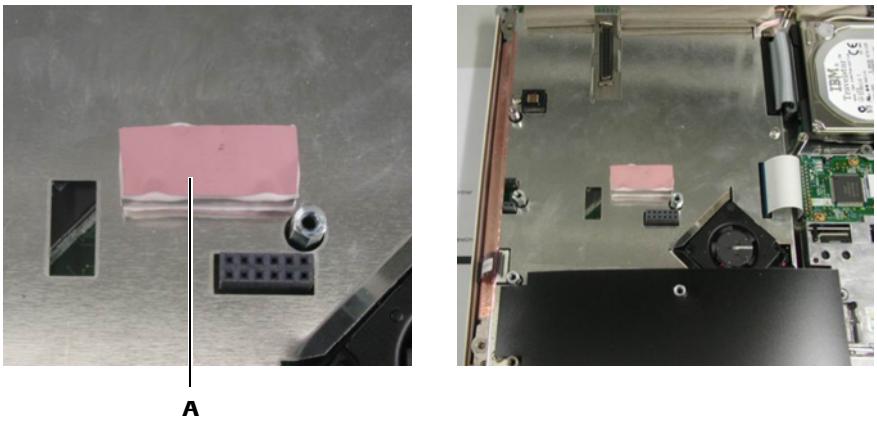
6 Remove battery and charger.

Use the reverse order for assembly.

- *Be careful of the plastic washers during installation!*
- *When installing the battery and charger circuit in a touch screen/PC unit with a serial number < 1500, it is necessary to affix an aluminum block (thermal cooling interface) to the housing!*

- Peel of the film of the aluminum block by using tweezers (the thicker side of the SILPAD) and position it as Figure below (the thicker side of the SILPAD toward the metal plate).

Peel off the foil on one side of the aluminum block only!



A Aluminium Block

Figure B-79 Aluminium Block

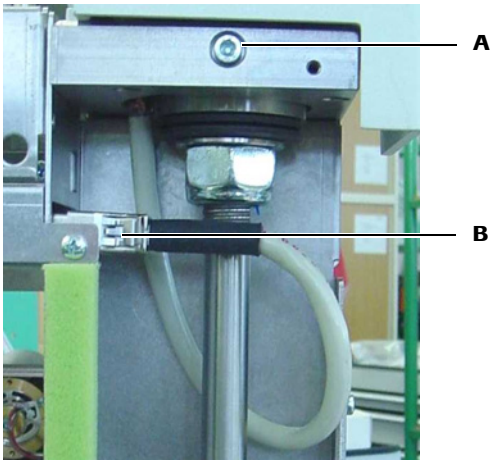
Replacing the screen cable

1 Remove the rear panel.

For instructions, see *Removing the rear panel* on page B-20.

2 Disconnect the screen cable at the interface unit and at the touch screen/PC unit.

3 Unscrew the screw holding the swivel arm with an Allen wrench (see below) and remove the swivel arm of the touch screen/PC unit.



A Fixing axis of the swivel arm **B** Screen cable

Figure B-80 Fixing axis of the swivel arm

4 Unscrew the two screws holding the screen cable on the bottom of the swivel arm.

5 Open the two clips and remove the screen cable.

6 Fasten the two clips to the new screen cable.

Use the reverse order for assembly.

Software update

General

The actual software version can be used for a software update of a **cobas b** 221 system currently running software version ≥ 1.00 – 0316.

Software packages

The **cobas b** 221 system software is available in different formats for different purposes. To find the correct format for each update option refer to the following table.

	Package type	Package contents
Floppy	Floppy package	Disk01: actual.opp, depend, disks.idx, disk_aa
		Disk02: disk_ab
		Disk03: disk_ac
		Disk04: disk_ad
		Disk05: disk_ae
USB/FTP	USB-FTP package	Files: actual.opp, depend, opp-V.VV-BBB.i386.rpm[(a)]
(Videos)	Video Sequences CD	Files: depend, omnis_videos-1.1.0-01.i386.rpm

Table B-4 Software packages contents

(a) V.VV indicates the current software version; BBB indicates the build number.

👁 See GRIPS for the latest instrument software: http://grips.mah.roche.com/.

Software update with floppy disks

For the software update with floppy disks, the system disks **cobas b** 221 system or the Floppy software package and empty floppy disks are necessary.

► Preparing empty floppy disks

1 Download the latest floppy software package and extract the zip file. This is not required if the "**cobas b** 221 system System Disks" are available.

👁 For details, see Table B-4 on page B-104.

2 Copy the contents of each folder ("Disk01", "Disk02", ...) to an empty floppy disk. Do not format the empty floppy disks before copying.

Proceed with the next procedure.

► Performing a software update with floppy disks

☞ At the ready screen, press [System] > [Utilities] > [Shutdown PC].

1 Turn of the instrument after shutting down and wait at least 3 minutes.

2 Insert the first disk into the floppy disk drive and switch on the instrument.

3 The software update will be started. Follow the instructions on the screen – insert the next floppy disk when needed and touch the screen.

4 Remove the last floppy disk after the update was finished.

5 **Shut down and restart the instrument manually.** The **cobas b** 221 system automatically warms up, performs a calibration and is ready again.

Software update with USB mass storage

For the software update (as well as video sequences update) with USB mass storage a USB flash drive is necessary.

Requirements for USB software update

*USB software update requires software version 5.00 or higher to be installed on instruments using touch screen-PC units version 4.X or higher and interface unit **cobas b** 221 system > SN 3000.*

For details, see **cobas b** 221 system *Spare Part List*, section *Touch Screen-PC Unit*.

► Preparing the USB mass storage

1 Download the latest USB-FTP software package and extract the zip file.

For details, see Table B-4 on page B-104.

2 Create the following folders in the root folder of the USB mass storage:

Roche\swupdate\

3 Place the software update package into the folder *swupdate*.

► Performing a software update with USB mass storage

At the ready screen, press [System] > [Utilities] > [Communication] > [SW upgrade].

1 Connect the USB mass storage to the USB port at the rear of the instrument. No further settings are required.

2 Press [Update from USB device]. The software update will be started.

3 After successful completion of the software update, a message will be shown. Restart the PC-software by pressing [Yes] in order to activate the new software version.

4 **Shut down and restart the instrument manually.** The **cobas b** 221 system automatically warms up, performs a calibration and is ready again.

Software update with FTP

The software update needs a FTP server software that can be purchased separately in specialized trade. For this software, Roche cannot grant any support.

Apply the network settings on the computer: On Roche CODEX COE 3.1-PCs, they are located in the Start Menu, (Settings >) Control Panel > Network Connections:

► Preparing the FTP server

1 Download the latest USB-FTP software package and extract the zip file.

For details, see Table B-4 on page B-104.

2 Select the network connection that will be used for connecting the computer and the **cobas b** 221 system.

3 Select Properties in the context menu (right-click with the mouse).

4 In the network protocol area, select "Internet Protocol (TCP/IP)" and click to "Properties".

Note the current settings to restore them after the software update.

5 Enter the following settings:

IP address: 192.168.0.100
Net mask: 255.255.255.0

No further settings are required.

6 Install the FTP server software on the computer (standard PC or Laptop with ethernet network connection) according to the instructions of the manufacturer. Place the FTP software package into the folder *swupdate*.

► Preparing the cobas b 221 system

1 Select [Settings] > [Interfaces] > [Network].

2 Enter the following settings:

IP address: 192.168.0.101
Net mask: 255.255.255.0

No further settings are required.
Press the "Back" button to save this settings.

► Connecting the FTP server and the cobas b 221 system

1 Connect the computer and the **cobas b** 221 system using a crossover RJ45 network cable (available in specialized trade).

- *Direct network connections between PC and **cobas b** 221 system are only possible by using a crossover network cable.*
- *Verify proper connection using the command PING on the computer.*
  Therefore, select Start - Run and enter CMD (or COMMAND).
  Enter PING 192.168.0.101 in the command prompt-a proper connection will respond with "Reply from 192.168.0.101 ...". When "Request timed out." is shown, inspect the network settings and the cabling.

2 Run the FTP server software on the computer.

The software update package must be placed into the FTP folder (root folder of the server) or a sub folder.

Details on the settings of the FTP server can be found in the documentation of the manufacturer.

► Performing a software update with FTP

☞ At the ready screen, press [System] > [Utilities] > [Communication] > [SW upgrade].

1 Apply the settings according to the settings of the computer:

Server: 192.168.0.100
Path: /
User: anonymous
Password: update

When using the anonymous access, the serial number of the **cobas b** 221 system will be automatically used as password. Possibly the anonymous access of the FTP server is deactivated and protected with user name and password. When the software package is not in the root folder of the ftp server, the path has to be adjusted accordingly.

2 Press [Update from network]. The software update will be started.

3 After successful completion of the software update, a message will be shown. Restart the PC-software by pressing [Yes] in order to activate the new software version.

4 **Shut down and restart the instrument manually.** The **cobas b** 221 system automatically warms up, performs a calibration and is ready again.

If the software update does not complete, the status messages can give conclusion on the error source. Under normal conditions, "Connected to 192.168.0.100" is shown in the first line. This indicates a proper connection to the FTP server. However if "Not connected" appears, verify the network connection and settings. "550 File does not exits." indicates that the installation package is in another path or not present on the server.

Update of video sequences

The update of the video sequences is available for touch screen/PC units "new" version 3.x or later for instruments with a serial number > 1500 or higher!

The playback of the videos is possible with software version 4.00 or later only!

Never perform the update of video sequences together with a software update!

The software update package has to be removed from the FTP server or moved to a different FTP folder.

An update of video sequences is similar to a software update with FTP or USB mass storage, the playback of the videos is possible with software version 4.00 or later. This requires the "**cobas b** 221 system Video Sequences CD".

👁 For details, see **cobas b** 221 system *Spare Part List*, section *Service Documentation*.

► USB video sequences update

1 Perform a software update if necessary and restart the **cobas b** 221 system.

2 Prepare the PC and the **cobas b** 221 system same as *Preparing the USB mass storage*.

👁 For details, see *Software update with USB mass storage* on page B-105.

3 Instead of the software update package, copy the video sequences update package from the Video Update CD into the folder "Roche\swupdate\".

4 Continue with *Performing a software update with USB mass storage*.

► **FTP video sequences update**

1 Perform a software update if necessary and restart the **cobas b** 221 system.

2 Prepare the PC and the **cobas b** 221 system same as for the software update with FTP until *Connecting the FTP server and the cobas b 221 system*.

👁 For details, see *Software update with FTP* on page B-105.

3 Instead of the software update package, copy the video sequences update package from the Video Update CD into a new sub folder (e.g. "/video") or into an empty FTP folder. For USB use the folder "/Roche/swupdate".

4 Continue with *Performing a software update with FTP*. As the path for the installation, select the new folder (e.g. "/video") on the **cobas b** 221 system.

Due to the amount of data, the update may need several time to finish, depending on the transfer rate.

Printer

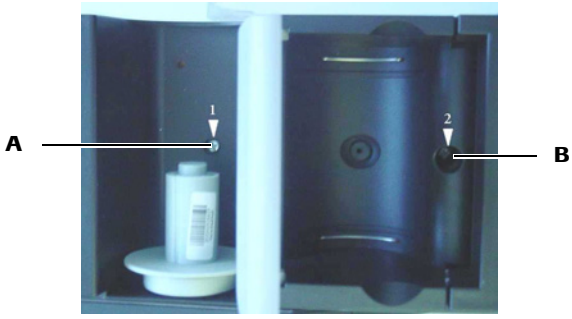
Replacing the Printer

1 Remove the top cover, printer cover and T&D cover of the **cobas b** 221 system.

2 Remove the printer paper and press the printer lever on the right side back.

3 Pull the paper winder out to the right.

4 Unscrew the two screws holding the printer unit (see below, A and B).



A Screw **B** Screw

Figure B-81 **cobas b** 221 system printer unit

5 Lift the printer and disconnect the connector cable from the printer unit.

6 Remove the printer unit.

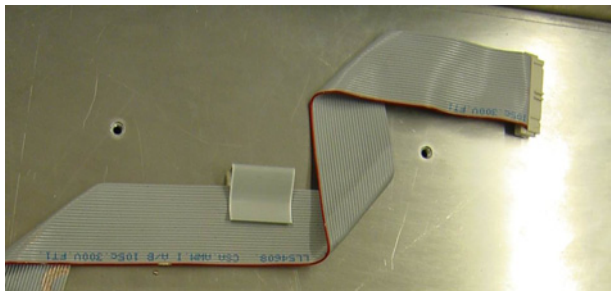


Figure B-82 Printer connector cable

Use the reverse order for assembly.

During assembly, observe the position of the printer connector cable (see above).

Replacing the winder unit

1 Disassemble the printer unit.

For instructions, see *Replacing the Printer* on page B-108.

2 Unscrew the screw holding the winder unit on the bottom of the printer unit.

3 Disconnect the cable connector and remove the winder unit.

Use the reverse order for assembly.

During initial installation of the winder unit the plastic bar on the winder unit must be broken off to allow the unit to be attached.

Replacing the paper lid

1 Remove the paper cover.

2 Press the paper cover to the left and pull it up.

Use the reverse order for assembly.

Replacing the printer-cutter lid

1 Remove the printer lid and open the printer-cutter lid.

2 Press the printer-cutter lid to the left or right and pull it up.

Use the reverse order for assembly.

Fan unit

Replacing the main fan unit

1 Remove the top cover, printer cover and T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Unscrew the two screws holding the main fan unit and lift it up.

7 Disconnect the two connector cables of the fan unit at the mainboard and remove the fan unit.

Use the reverse order for assembly.

Replacing the valve bus cable

1 Remove the top cover, printer cover and T&D cover of the **cobas b** 221 system.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Disassemble the fan shield.

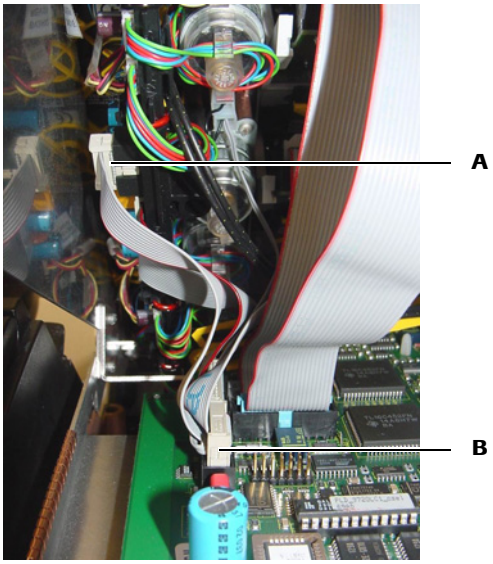
For instructions, see *Replacing the main fan unit* on page B-110.

7 Unscrew the two screws holding the mainboard retainer.

For details, see Figure B-66 on page B-89.

8 Fold the mainboard retainer down.

9 Release the valve bus cable plug connector on the sample distributor (see below).

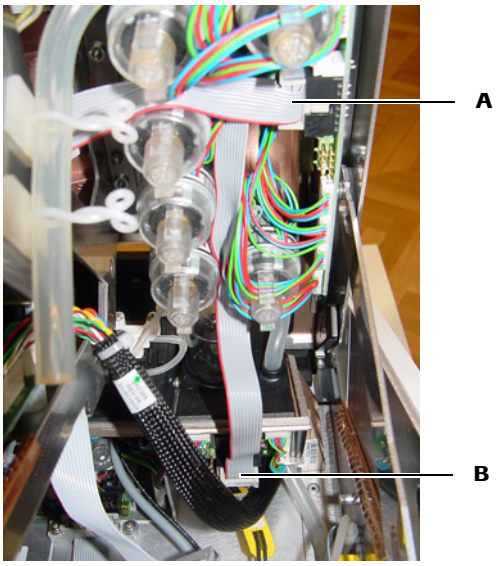


A Plug connector on the sample distributor **B** Plug connector on the mainboard

Figure B-83 Valve bus cable (Sample distributor/mainboard)

10 Release valve bus cable connector on the mainboard (see above).

11 Release the valve bus cable plug connector on the measuring chamber cartridge valve unit (see below).



A Plug connector on the measuring chamber cartridge valve unit **B** Plug connector on the V4/V6 actuator board

Figure B-84 Valve bus cable

12 Release the valve bus connector cable on the V4/V6 actuator board and remove the cable (see above).

Use the reverse order for assembly.

Replacing the actuator bus main controller cable

1 Remove the rear panel.

For instructions, see *Removing the rear panel* on page B-20.

2 Rotate the T&D lock on the T&D module 90 degrees to the right.

For details, see Figure B-4 on page B-22.

3 Carefully pull the sample inlet path out to the right and remove it.

4 Unscrew the three screws holding the central measuring unit.

For details, see Figure B-2 on page B-20.

Do not remove the fastening screws completely, because they are secured against loss.

5 Raise the central measuring unit forward until it clicks audibly into place.

The sample inlet path must be removed at this time, otherwise it will be destroyed by folding the central measuring unit out.

6 Remove the light guide conduit with the COOX light guide.

For instructions, see *Replacing the primary light guide* on page B-56.

7 Remove the two screws holding the actuator bus plug.

8 Release the controller cable connector on the hemolyzer.

9 Release the controller cable connector on the vacuum control board.

10 Release the controller cable connector on the FMS control board.

11 Release the controller cable connector on the T&D module.

12 Pull the controller cable out of the cable guide and remove it.

Use the reverse order for assembly.

Barcode scanner

General

Type	Hand scanner with integrated decoder
Read rate	up to 45 scans/sec.
Resolution	0,1 mm
Reading distance	up to 5 cm
Reading width	up to 8 cm

Table B-5 Barcode scanner characteristics

Interface pin assignment:

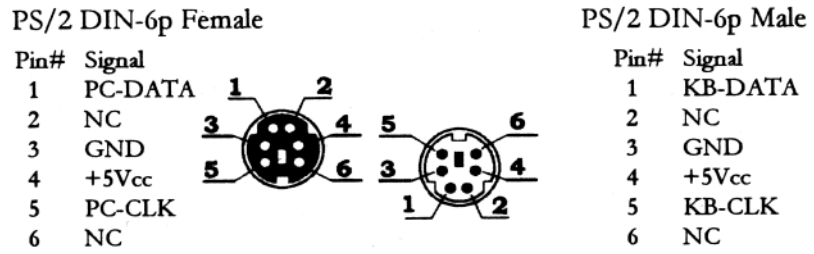


Figure B-85 Interface pin assignment

The barcode scanner is pre-programmed for the following barcode types:

- China Postal Code
- Codabar
- Code 39
- Code 128
- EAN-8
- EAN-13
- EAN-128
- Interleaved 2 of 5
- UPC-A

- UPC-E

More available barcode types can be programmed according to the enclosed manual of the PS2 hand-held scanner (included in delivery).

Following barcode types are used for electrodes, QC materials and solutions:

Type	Barcode type	Check Digits	Length max
Electrodes	Code 39	without	
QC materials	Interleaved 2 of 5	without	8 cm
Solutions	Interleaved 2 of 5	without	

Reprogramming of the barcode types "Code 39" and "Interleaved 2 of 5" (without "Check Digits") is not allowed. The respective electrode, solution, QC and barcode data can no longer be read in.

If it is necessary to use one of the two barcode types with "Check Digits", a second barcode scanner programmed specifically for the customer must be connected.

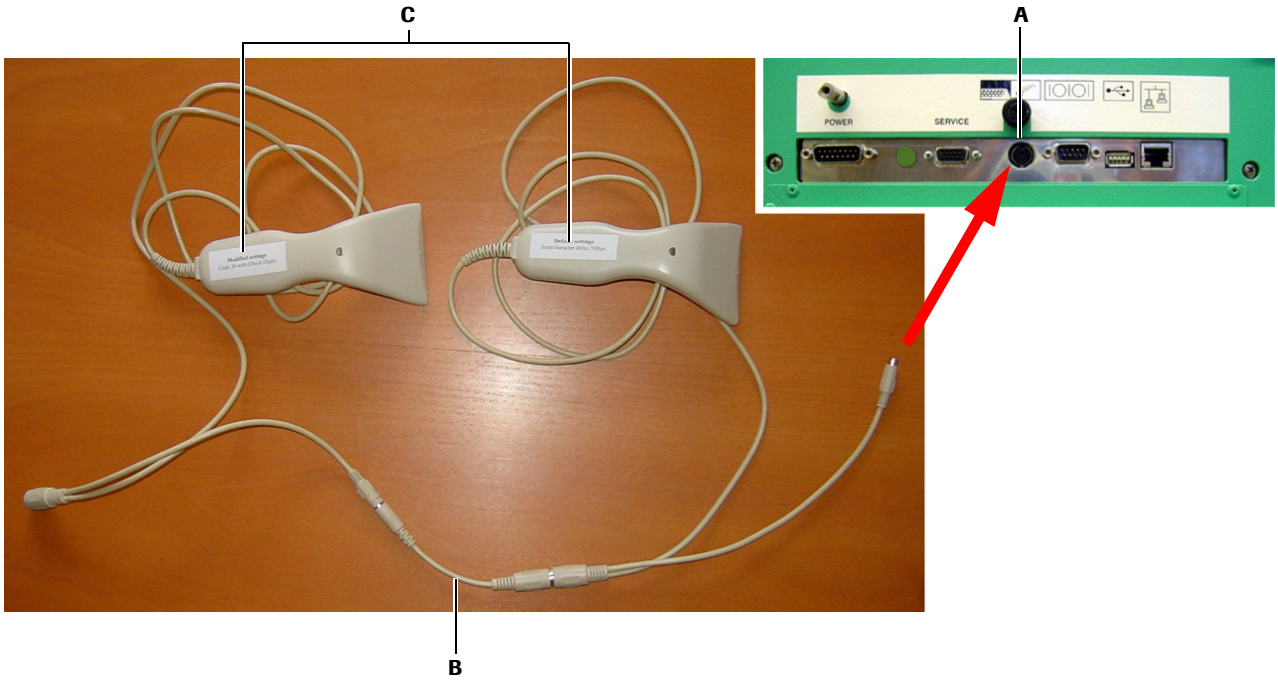
Connection of a second barcode scanner

If it is necessary to use one of the two barcode types Code 39 or Interleaved 2 of 5 with "Check Digits", a second barcode scanner programmed specifically for the customer must be connected.

👁 Information on programming can be found in the enclosed manual for the PS2 hand-held scanner (included in the scope of delivery).

The same type must be used as second barcode scanner. This is connected by means of an adapter cable (included in scope of delivery) (see below).

👁 A further barcode scanner can be ordered on the basis of the Spare Part List.



A PS/2 DIN 6-pin female plug **B** adapter cable (included in delivery) **C** marking of the barcode scanners

Figure B-86 Connection of a second barcode scanner

In event of connection of a second barcode scanner programmed specifically for the customer, both barcode scanners must be clearly marked for the user in order to prevent confusion (see above).

For both barcode scanners an inter character delay of 500 µs must be set.

The user must carry out a plausibility check for all barcode data read in and displayed by the instrument!

Testing the barcode scanner

☞ At the ready screen, press
[System] > [Component test] > [PC components] > [Barcode].

Read in a barcode. The displayed number on the screen must be identical with the number below the barcode.

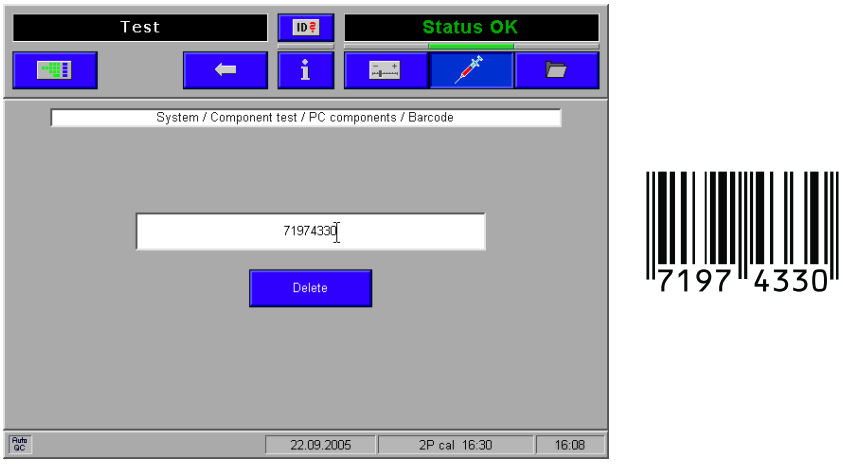


Figure B-87 Testing the barcode scanner

AutoQC module

This chapter provides servicing information about the AutoQC module.

In this chapter *Chapter* 5

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Initial installation of the AutoQC module 121
Replacing the AutoQC module 122
Replacing the AQC snap lock 124
Replacing the AQC magnetic valve 125
Replacing the AQC board 126
Replacing the YZ distributor board 127
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Replacing the flex cable (short) 129
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Replacing the AQC sample tube complete 131
Replacing the AQC sample tube short 132
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Replacing the X motor 133
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Replacing the Z motor 134
Replacing the AutoQC steel tube 135
Replacing the AQC temperature sensor 136
Replacing the wash port 137
Replacing the toothed belt (short) 138
Replacing the toothed belt (long) 139

AutoQC preparation for maintenance

Whenever performing maintenance steps on the AutoQC module, be sure to perform the following steps:

1 Open the AutoQC drawer and remove the ampoule block.

2 Loosen the two slide cover screws by turning them about one revolution.

3 Remove the protective cover.

A AutoQC protective cover srews

Figure B-88

The protective cover screws can be removed in AutoQC home position only!

Perform maintenance. Use the reverse order for assembly.

Initial installation of the AutoQC module

1 Switch off the **cobas b** 221 system.

2 Remove the back panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

3 Unscrew the two shipping screws wrapped with a red band on the AutoQC module.

4 Remove the red shipping valve cap from the AQC magnetic valve.

5 Unscrew the two screws holding the AutoQC drawer cover on the bottom of the **cobas b** 221 system and fasten the drawer cover to the AutoQC module.

6 Remove the AutoQC snap lock from the module and plug it into the matching opening in the **cobas b** 221 system.

For details, see Figure B-93 on page B-123.

7 Slide the AutoQC module into the opening and fasten it to the bottom of the **cobas b** 221 system with the two fixing screws.

*The AutoQC module rails must fit flush to the **cobas b** 221 system cover frame so the two fixing screws can grip.*

8 Remove the cylinder pin from the AQC rinse tube and connect the rinse tube to the angled nipple.

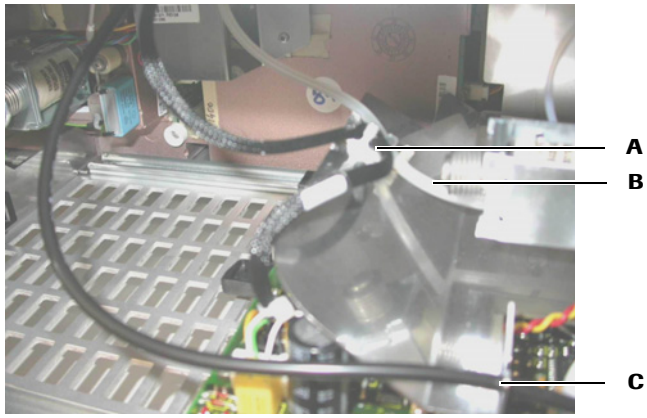
For details, see Figure B-90 on page B-121.

9 Connect the AQC sample tube to the angle unit.

For details, see Figure B-89 on page B-120.

10 Push the connector cable through the AQC board cover and connect it to the AutoQC control board.

For details, see:
Figure B-89 on page B-120
Figure B-90 on page B-121



A Connector cable
B Rinse tube
C Sample tube

Figure B-89 AutoQC module: rinse tube, sample tube, connector cable

Replacing the AutoQC module

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

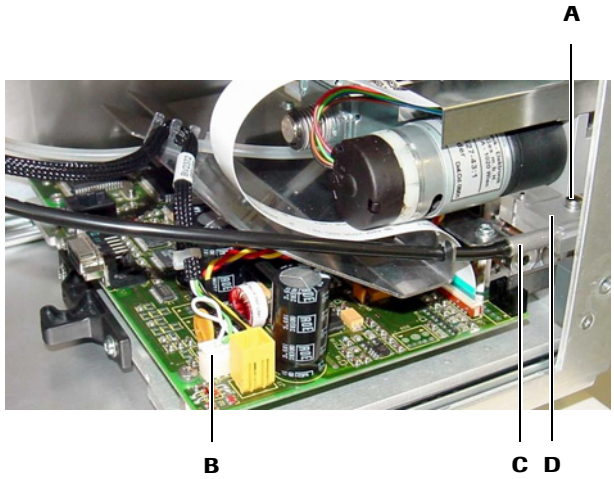
2 Remove the back panel of the instrument.

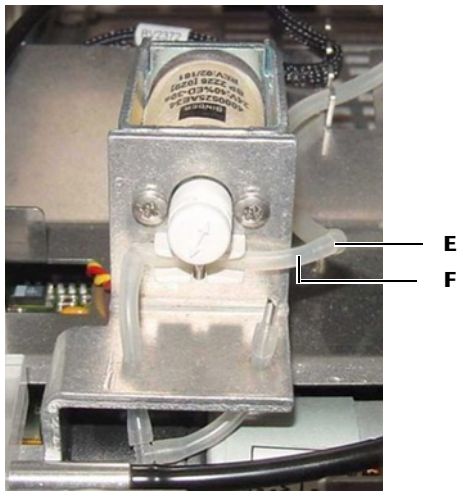
For instructions, see *Removing the rear panel* on page B-20.

3 Pull the AutoQC module out to the left.

4 Disconnect the AQC sample tube at the angle unit and pull it out.

For details, see Figure B-90 on page B-121.



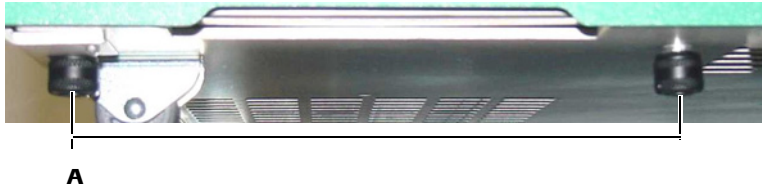


A Screw holding the angle unit
B Connector cable
C AQC sample tube
D Angle unit
E Wash tube
F Angled nipple

Figure B-90 Auto QC module - cable and tube connections

5 Disconnect the cable (at the board) and the wash tube (at the angled nipple) (see above).

6 Unscrew the two screws holding the AutoQC module on the bottom of the **cobas b** 221 system (see below, A).



A Two AutoQC fixing screws

Figure B-91 AutoQC fixing screws

7 Pull the AutoQC module out to the left and remove it.

Use the reverse order for assembly.

Replacing the AQC snap lock

The snap lock of the **cobas b** 221 system AutoQC module consists of two parts. Part a is fixed to the AutoQC module; part b is fixed to the right frame of the **cobas b** 221 system.

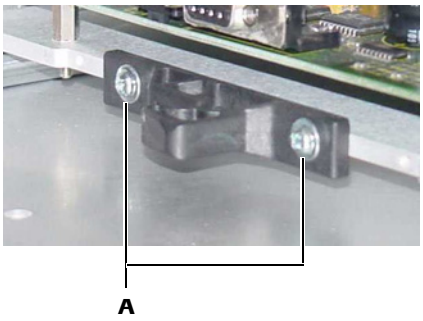
► To replace the AQC snap lock (a)

1 Remove the back panel of the instrument .

👁 For instructions, see *Removing the rear panel* on page B-20.

2 Pull the AutoQC module out to the left.

3 Unscrew the two screws holding the snap lock on the back of the AutoQC module and remove them (see below, A).



A Two screws holding the snap lock

Figure B-92 Snap lock (a)

Use the reverse order for assembly.

► To replace the snap lock (b)

1 Remove the back panel of the instrument.

👁 For instructions, see *Removing the rear panel* on page B-20.

2 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

3 Pull the AutoQC module out to the left.

4 Press the brackets on the back of the snap lock and slide it through the opening towards the AutoQC module.

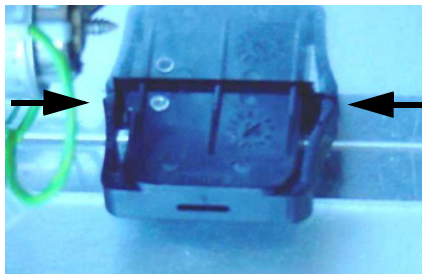


Figure B-93 Snap lock (b)

Use the reverse order for assembly.

Replacing the AQC magnetic valve

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

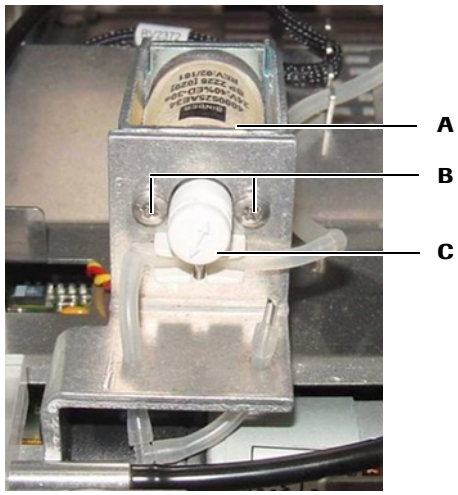
1 Switch off the **cobas b** 221 system.

2 Remove the back panel of the instrument.

👁 For instructions, see *Removing the rear panel* on page B-20.

3 Pull the AutoQC module out to the left.

4 Remove the cap from the magnetic valve (see below).



A Magnetic valve
B Two screws holding the magnetic valve
C Cap

Figure B-94 AutoQC magnetic valve

5 Unscrew the two screws holding the magnetic valve (see above).

6 Pull the connector cable from the board and remove the magnetic valve.

Use the reverse order for assembly.

Activate the function program ☞ [System] > [Component test] > [Valves] > [AQC module] to test the functioning of the magnetic valve.

Replacing the AQC board

Electrostatically sensitive component!

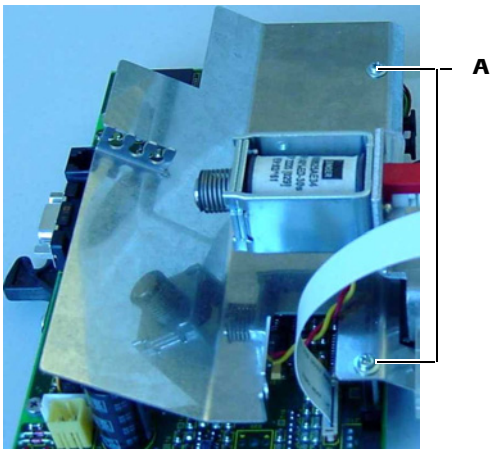
Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Disassemble the AutoQC module.

👁 For instructions, see *Replacing the AutoQC module* on page B-120.

3 Unscrew the two screws holding the AutoQC control board cover and remove it (see below, A).

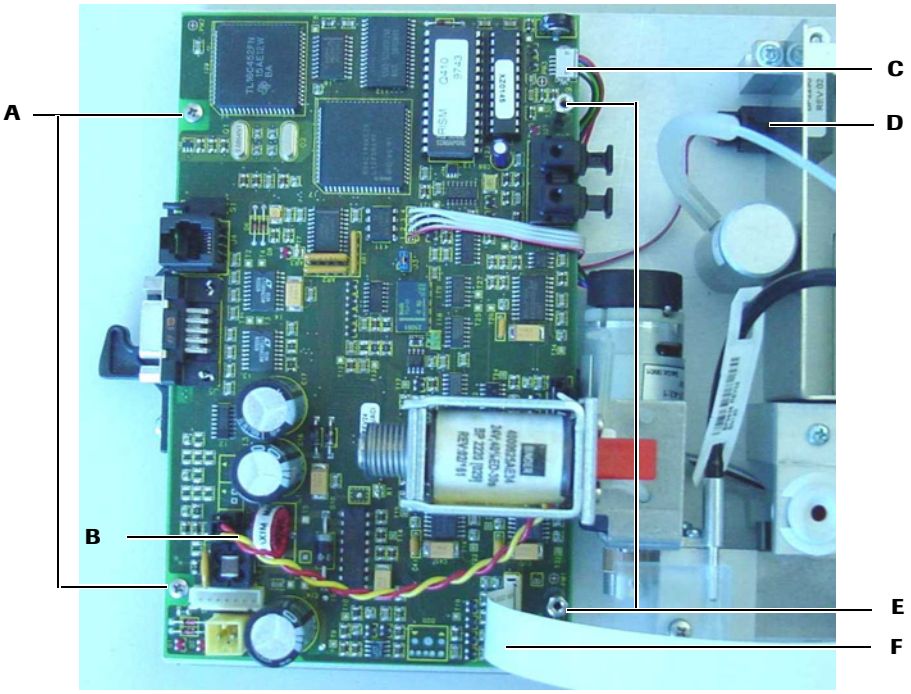


A Two screws holding the AutoQC control board

Figure B-95 AutoQC board cover

4 Pull all cables (names: J8, J9, J11, J14) from the AutoQC control board as well as the temperature sensor cable out.

First unlock the flex cable connector by lifting the ends of the connector then pull the cable from the board.



A Two screws holding the AutoQC control board
B Magnetic valve cable (J11)
C XY motor cable (J9)
D Temperature sensor cable
E Two spacer pins
F Flex cable (long) (J8)

Figure B-96 AutoQC Control Board

5 Unscrew the two screws (A) holding the AutoQC control board, remove the two spacer pins (E) (see above) and remove the AutoQC control board.

Use the reverse order for assembly.

Activate the function program ☞ [System] > [Protected functions] > [AQC compensation] to run a position compensation in the x and y direction.

Replacing the YZ distributor board

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

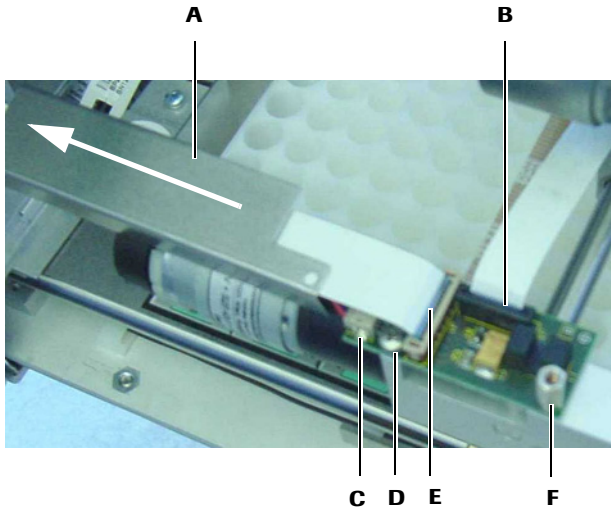
3 Loosen the two screws holding the AutoQC cover by turning them about one revolution.

4 Pull the AutoQC cover back and then left.

5 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

6 Pull the cross-slide cover up.

7 Unscrew the cable guide fixing screw on top of the YZ distributor board and pull the cable guide to the right (see below).



A	Cable guide	**D**	Fixing screw
B	Flex cable (short)	**E**	Flex cable (long)
C	Motor cable	**F**	Spacer pin

Figure B-97 YZ distributor board

8 Pull the motor cable and the two flex cables (short and long) from the YZ distributor board (see above).

First unlock the flex cable connector by lifting the ends of the connector then pull the cable from the board.

9 Unscrew the screw holding the YZ distributor board, disassemble the spacer pin and remove the YZ distributor board (see above).

Use the reverse order for assembly.

Replacing the Z distributor board

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

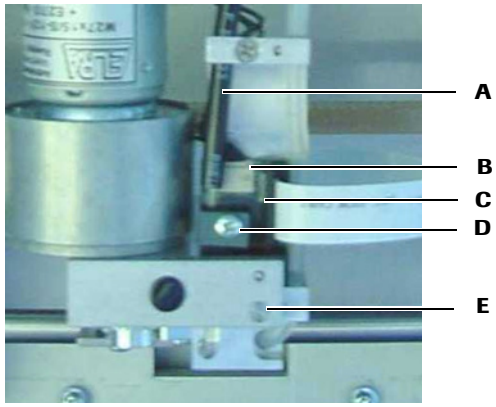
3 Loosen the two screws holding the AutoQC cover by turning them about one revolution.

4 Pull the AutoQC cover back and then left.

5 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

6 Pull the cross-slide cover up.

7 Unscrew the screw holding the Z distributor board.



A AQC sample tube
B Motor cable
C Flex cable (short)
D Fixing screw
E Setscrew

Figure B-98 Z distributor board

8 Disconnect the AQC sample tube, the motor cable and the flex cable (short) from the Z distributor board (see above).

First unlock the flex cable connector by lifting the ends of the connector then pull the cable from the board.

9 Unscrew the cross-slide axis setscrew and remove it upwards (see above).

10 Remove the cross-slide unit and the Z distributor board.

Use the reverse order for assembly.

Replacing the flex cable (short)

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Loosen the two screws holding the AutoQC cover by turning them about one revolution.

4 Pull the AutoQC cover back and then left.

5 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

6 Pull the cross-slide cover up.

7 Unscrew the screw holding the cable guide on top of the YZ distributor board and remove the cable guide to the right.

For details, see Figure B-97 on page B-126.

8 Remove the flex cable (short) on the Z distributor board and on the YZ distributor board.

For details of the Z distributor board, see Figure B-98 on page B-127.
For details of the YZ distributor board, see Figure B-97 on page B-126.

First unlock the flex cable connector by lifting the ends of the connector then pull the cable from the board.

Use the reverse order for assembly.

Replacing the flex cable (long)

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Unscrew the screw holding the cable guide on top of the YZ distributor board and move the cable guide to the right.

For details, see Figure B-97 on page B-126.

4 Remove the flex cable (long) on the YZ distributor board and on the control board.

For details of the YZ distributor board, see Figure B-97 on page B-126.
For details of the control board, see Figure B-96 on page B-125.

First unlock the flex cable connector by lifting the ends of the connector then pull the cable from the board.

Use the reverse order for assembly.

AQC sample tube

Replacing the AQC sample tube complete

The AQC sample tube complete consists of:

- AQC sample tube short
- AQC sample tube long
- AutoQC safety spring
- AutoQC angle unit

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Remove the back panel of the instrument.

👁 For instructions, see *Removing the rear panel* on page B-20.

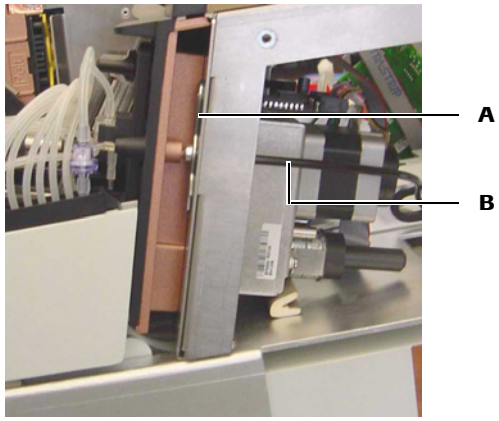
4 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

5 Remove the AQC sample tube from the cross-slide.

👁 For details, see Figure B-98 on page B-127.

6 Remove the safety spring of the AQC sample tube on the back of the T&D module and disconnect the AQC sample tube and remove it (see below).



A Safety spring **B** AQC sample tube

Figure B-99 AutoQC AQC sample tube and safety spring

7 Unscrew the screw (A) holding the angle unit and remove the angle piece with the AQC sample tube.

For details, see Figure B-90 on page B-121.

Do not remove the fastening screws completely, because they are secured against loss.

Use the reverse order for assembly.

Replacing the AQC sample tube short

Activate the function program [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Remove the AQC sample tube (short) from the cross-slide.

For details, see Figure B-98 on page B-127.

4 Disconnect the AQC sample tube (short) from the angle unit and remove it.

Use the reverse order for assembly.

Replacing the AQC sample tube long

Activate the function program [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Remove the back panel of the instrument.

For instructions, see *Removing the rear panel* on page B-20.

4 Unscrew the four screws holding the right side panel and remove the side panel.

Do not remove the fastening screws completely, because they are secured against loss.

5 Remove the AQC sample tube from the cross-slide.

For details, see Figure B-98 on page B-127.

6 Remove the safety spring of the AQC sample tube (long) on the back of the T&D module and disconnect the AQC sample tube and remove it.

For details, see Figure B-99 on page B-129.

7 Disconnect the AQC sample tube (long) from the angle unit and remove it.

Use the reverse order for assembly.

Replacing the X motor

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Disassemble the AutoQC module.

👁 For instructions, see *Replacing the AutoQC module* on page B-120.

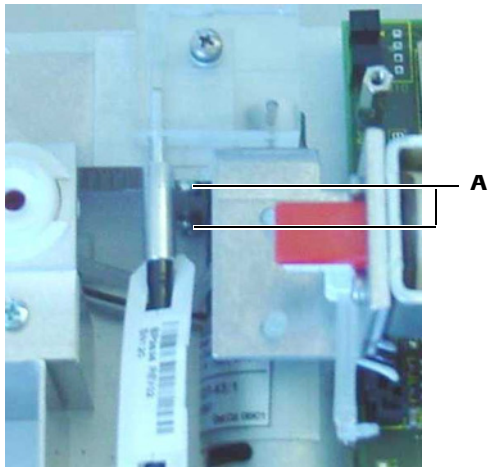
3 Unscrew the two screws holding the AutoQC control board cover and remove it.

👁 For details, see Figure B-95 on page B-124.

4 Disconnect the X motor cable on the control board.

👁 For details, see Figure B-96 on page B-125.

5 Unscrew the two screws holding the X motor retainer (see below) and remove the retainer.



A Fixing screws of the X motor retainer

Figure B-100 X motor retainer

6 Unscrew the two X motor fixing screws and remove the motor.

7 Remove the gear wheel from the motor and attach it to the new motor.

Use the reverse order for the further assembly.

Replacing the Y motor

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Loosen the two screws holding the AutoQC cover by turning them about one revolution.

4 Pull the AutoQC cover back and then left.

5 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

6 Pull the cross-slide cover up.

7 Unscrew the screw holding the cable guide on top of the YZ distributor board and move the cable guide to the right.

👁 For details, see Figure B-97 on page B-126.

8 Disconnect the motor cable from the YZ distributor board.

👁 For details, see Figure B-97 on page B-126.

9 Unscrew the two screws holding the motor and remove the Y motor.

10 Remove the gear wheel from the motor and attach it to the new motor.

Use the reverse order for the further assembly.

Replacing the Z motor

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Loosen the two screws holding the AutoQC cover by turning them about one revolution.

4 Pull the AutoQC cover back and then left.

5 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

6 Pull the cross-slide cover up.

7 Disconnect the motor cable from the Z distributor board.

👁 For details, see Figure B-98 on page B-127.

8 Unscrew the cross-slide axis setscrew and pull it up.

For details, see Figure B-98 on page B-127.

9 Unscrew the two screws holding the motor and remove the Z motor.

10 Remove the gear wheel and the guide sleeve from the motor and attach them to the new motor.

Use the reverse order for the further assembly.

Replacing the AutoQC steel tube

Activate the function program [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Loosen the two screws holding the AutoQC cover by turning them about one revolution.

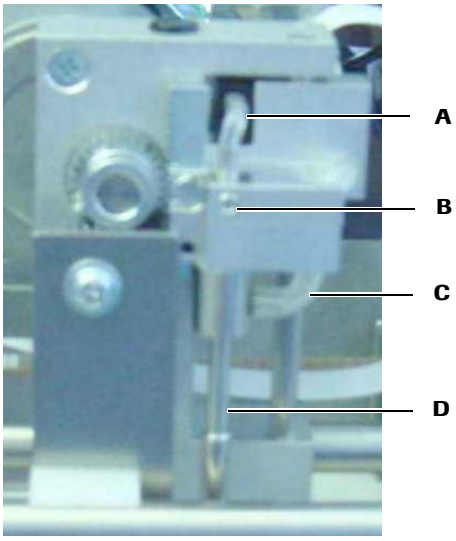
4 Pull the AutoQC cover back and then left.

5 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

6 Pull the cross-slide cover up.

7 Disconnect tube (see below, A) on the steel tube from the AQC needle.

8 Unscrew the setscrew of the steel tube (see below).



A Tube on the steel tube from the AQC needle
B Setscrew
C Tube from the steel tube
D Steel tube

Figure B-101 AutoQC steel tube

9 Release tube (see above, C) from the steel tube and pull the steel tube down and out.

Use the reverse order for assembly.

Make sure that the steel tube connector tube for the silicone tube points forward!

Replacing the AQC temperature sensor

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

*The **cobas b** 221 system must always be switched off, because the new AutoQC temperature sensor must be configured. This is done after the boot process.*

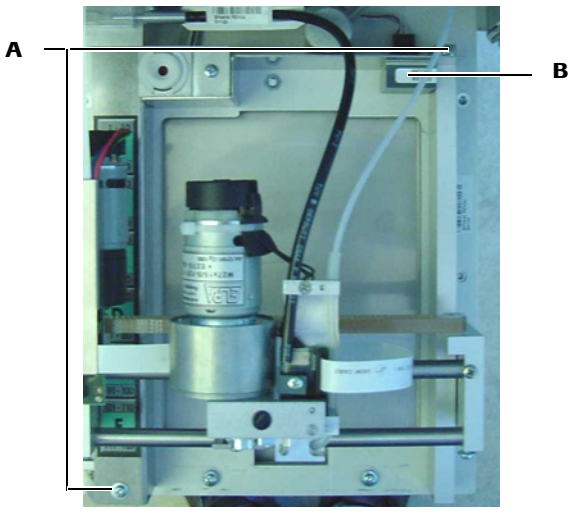
The AutoQC temperature sensor must not be connected or disconnected with the power on.

2 Pull the AutoQC module out to the left.

3 Disconnect the cable from the AutoQC temperature sensor.

👁 For details, see Figure B-96 on page B-125.

4 Unscrew the two screws holding the longitudinal slide cover and remove it (see below, A).



A Two screws holding the longitudinal slide cover **B** Temperature sensor

Figure B-102 Longitudinal slide cover

5 Remove the AutoQC temperature sensor and clean glue residues from the longitudinal slide cover.

6 Glue the new AutoQC temperature sensor to the longitudinal slide cover.

Use the reverse order for assembly.

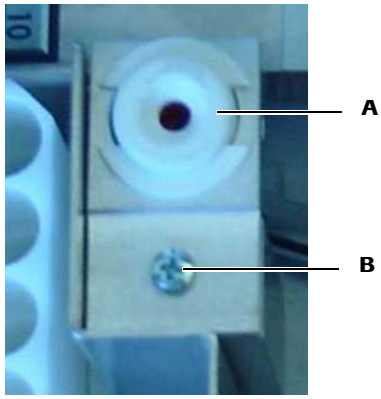
Replacing the wash port

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Unscrew the screw holding the wash port and remove it (see below).



A Wash port **B** Fixing screw

Figure B-103 Wash port

4 Disassemble the wash port retainer by pressing the two snap locks together and remove the wash port.

Use the reverse order for the further assembly.

Replacing the toothed belt (short)

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

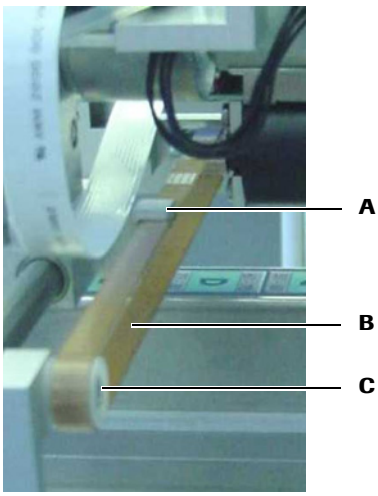
1 Switch off the **cobas b** 221 system.

2 Pull the AutoQC module out to the left.

3 Loosen the two screws holding the cross-slide cover by turning them about one revolution.

4 Pull the cross-slide cover up.

5 Unscrew the pulley screw (see below) and remove the toothed belt.



A Driver pin
B Toothed belt (short)
C Pulley

Figure B-104 Toothed belt (short)

6 Tension the new toothed belt over the toothed disk (see above) and over the pulley.

7 Fasten the toothed belt to the pulley with the screw.

8 Position the toothed belt on the driver pin of the cross-slide (see above).

Use the reverse order for the further assembly.

Replacing the toothed belt (long)

Activate the function program ☞ [System] > [Component test] > [Aggregates] > [AQC motors] > [AQC motors] > [Service Position] to bring the motors to the service position.

1. Switch off the **cobas b** 221 system.
2. Pull the AutoQC module out to the left.
3. Loosen the two screws holding the AutoQC cover by turning them about one revolution.
4. Pull the AutoQC cover back and then left.
5. Loosen the two screws holding the cross-slide cover by turning them about one revolution.
6. Pull the cross-slide cover up.
7. Unscrew the two screws holding the AutoQC control board cover and remove it.

   👁 For details, see Figure B-95 on page B-124.
8. Disconnect the cable from the AutoQC temperature sensor.

   👁 For details, see Figure B-96 on page B-125.
9. Unscrew the two screws holding the longitudinal slide and remove the shield.

   👁 For details, see Figure B-102 on page B-134.
10. Unscrew the pulley screw and remove the toothed belt.
11. Tension the new toothed belt over the toothed disk and over the pulley.
12. Fasten the toothed belt to the pulley with the screw.
13. Position the toothed belt on the driver pin of the longitudinal slide.

Use the reverse order for the further assembly.

Maintenance C

6 Maintenance C-3

Maintenance

This chapter provides information about annual and three-year maintenance.

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Decontamination

The following procedures are intended to prevent the risk of infection (including hepatitis and HIV) when replacing parts that were in contact with blood or other biological fluids.

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

Use only liquid disinfectant such as protein remover (Roche deproteinizer) or an alcohol-based (about 70%) surface disinfectant.

Do not spray disinfectant directly onto the instrument because this could cause malfunctions in the electronics.

Do not use any type of bleaching agent. Exception: Roche Deproteinizer.

Do not attempt to clean/decontaminate any part of the instrument before shutting it down and unplugging it from the power source.

Before plugging in the instrument again and switching it on always wait for 15 minutes to allow the disinfectant to evaporate.

Pay attention to *Disinfectants* on page A-7.

Surfaces

Important

Do not attempt to decontaminate any part of the instrument before shutting it down and unplugging it from the power source.

Before plugging the instrument back in and turning it on, always wait 15 minutes to allow the disinfectant to evaporate – Danger of fire and explosion!

For safety reasons, only authorized customer service personnel may decontaminate the power pack!

► Cleaning the surfaces

Regularly decontaminate all outer surfaces of the instrument, including all covers (e.g. printer cover, bottle compartment cover, top cover, T&D cover), with the disinfectant according to the lab-specific regulations.

Very dirty surfaces should first be cleaned with a swab or paper towel that has been soaked in distilled water. All removable covers (e.g. instrument cover) can be removed, sprayed with surface disinfectant and subsequently disinfected using swabs or cellulose.

Some surfaces require extended soaking to achieve cleaning.

Important

Never spray parts that cannot be removed or that are inside the instrument!

For details, see section *Decontamination* on page C-5!

Screen

► Cleaning the screen

1 Press ☞ [System] > [Wash & Clean] > [Clean screen]. The touch function of the screen is now deactivated for 30 seconds.

2 Clean the surface of the screen with a cloth moistened with disinfectant.

3 After 30 seconds the software automatically returns to the previous menu.

Clean only with a moist cloth (for example, one that is soaked with disinfectant).
Do not use water and sprays!

Barcode Scanner

► Cleaning the barcode scanner

Decontaminate the exterior surfaces of the barcode scanner with a cloth moistened with disinfectant.

Input unit

► Cleaning the input unit

Press ☞ [System] > [Wash & Clean] > [Clean input unit] and follow the instructions on the screen.

Modules and tubing paths

Module cleaning

If required, an internal cleaning procedure is automatically carried out during the 2P calibration and a system calibration (which similarly includes a 2P calibration)!

The instrument is delivered with the following standard settings for automatic internal cleaning:

Measuring module	Samples	Cycle
BG	500	never
ISE	200	never
COOX und tHb/SO_2	20	never
MSS	---	never

Table C-1 Standard settings for automatic internal cleaning

Automatic BG cleaning

If the automatic BG cleaning is activated, internal instrument data such as the measuring frequency and drift behavior of the sensors is used to automatically select an optimum cleaning interval.

For details, see *Reference Manual* chapter 3 *Setup*, section *Times & intervals* > *Maintenance schedule*.

External cleaning

An additional external cleaning with deproteinizer should only be carried out if the measuring chamber is contaminated (protein deposits) or if components of the sample path must be exchanged.

Activate the following function, starting with the top level of the analyzer mode:

☞ System > Wash & cleaning > Cleaning modules

Figure C-1 Cleaning modules

► Cleaning the BG- / ISE-/ COOX- or tHb/SO_2 module

Tip:

ISE module: the frequency of the cleaning process depends on the lab-specific type of sample (physiological, pathological, fetal blood).

BG module: should be cleaned only on demand, in the following scenario:

- *visible blood clot in the BG module*
- *low PO_2 QC recoveries due to microscopic bacterial contamination of the PO_2 electrode*

1 Activate the corresponding module and press ☞ [Start external cleaning].

2 The external cleaning agent is inserted like a sample (syringe or capillary) via the fill port.

3 Each external cleaning must be followed by a wetting using whole blood or serum, press:

☞ System > Utilities > Fluid actions > Wetting routines

4 Press ☞ [Start internal cleaning] to carry out a cleaning using the internal cleaning solution.

► Cleaning the MSS module (cobas b 221<5/6> systems only)

This cleaning should be performed with every exchange of the cassette, but not more than once per month (e.g. obstruction).

1 Activate the MSS module and press ☞ [Start external cleaning].

2 The external cleaning agent is inserted like a sample (syringe or capillary) via the fill port.

3 Insert a new MSS cassette using the correct procedure.

👁 For details, see *Instructions for Use*, *Changing the MSS cassette (cobas b 221<5> system and cobas b 221<6> system only)*.

After the cleaning, perform a polarization of the new MSS cassette.

Tubing paths

Using the function Decontamination all the tubing paths in the instrument can be decontaminated. ☞ System > Wash & cleaning > Decontamination

This decontamination is carried out in a similar way to the shut down routine, except that deproteinizer is used instead of distilled water. The shutdown kit is required for carrying out this function.

Attention

The decontamination procedure must be carried out completely and may not be interrupted.

Tip:

Observe the listed sequence while performing the actions.

► Starting the procedure

Manual The corresponding line of the list box contains an instruction which must be performed manually. Then press ☞ [Confirm action].

Automatic If there is an automatic sequence for any action, you can start this by pressing ☞ [Start process].

✓ If an action has been completed successfully (manually or automatically), this symbol is displayed.

Cleaning of the measuring chambers BG, ISE and MSS

1. Remove the **cobas b** 221 system top cover.
2. Open the appropriate measuring chamber.
3. Open the electrode clamping lever in the measuring chamber and remove the electrodes.
4. Clean the measuring chamber with a cloth moistened with disinfectant.
5. Plug the electrodes back into place and close the electrode clamping lever.

Close the measuring chamber and replace the top cover.

cobas b 221<1/3/5> systems (tHb/SO_2)

Yearly replacement

*Various components of the **cobas b** 221 system such as T&D module, tubes, waste container, etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

Sample needle	For instructions, see *Replacing the needle* on page B-23.
Fill port	For instructions, see *Replacing the fill port* on page B-23.
T&D tubing set	For instructions, see *Replacing the T&D tubing set* on page B-27.
PP pump tube	For instructions, see *Replacing the pump tube* on page B-67.
FMS tubing set	For instructions, see *Replacing the FMS tubing set* on page B-35.
Waste separator	For instructions, see *Replacing the waste separator* on page B-68.
Bypass nipple	For instructions, see *Replacing the bypass nipple* on page B-24.
Bacteria filter	For instructions, see *Replacing the bacteria filter* on page B-72.
Air filter	(On the rear panel of the instrument.)
T&D disk	For instructions, see *Replacing the T&D disk* on page B-26.
Check vacuum system	For instructions, see *Vacuum System* on page D-101.
Tubing set tHb/PolyOX	For instructions, see *Replacing the tubing set tHb/PolyOX* on page B-59.

The tubing paths must also be disinfected annually and the baro value must be checked.

Replace every three years

*Various components of the **cobas b** 221 system such as T&D module, tubes, waste container, etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

Sample needle	For instructions, see *Replacing the needle* on page B-23.
Fill port	For instructions, see *Replacing the fill port* on page B-23.
T&D tubing set	For instructions, see *Replacing the T&D tubing set* on page B-27.
PP pump tube	For instructions, see *Replacing the pump tube* on page B-67.
FMS tubing set	For instructions, see *Replacing the FMS tubing set* on page B-35.
Waste separator	For instructions, see *Replacing the waste separator* on page B-68.
Bypass nipple	For instructions, see *Replacing the bypass nipple* on page B-24.
Bacteria filter	For instructions, see *Replacing the bacteria filter* on page B-72.
Air filter	(On the rear panel of the instrument.)
T&D disk	For instructions, see *Replacing the T&D disk* on page B-26.
Tubing set tHb/PolyOX	For instructions, see *Replacing the tubing set tHb/PolyOX* on page B-59.
Sample distributor cartridge	For instructions, see *Replacing the sample distributor cartridge* on page B-35.
Measuring chamber cartridge	For instructions, see *Replacing the measuring chamber cartridge* on page B-48.
Hb cartridge	For instructions, see *Replacing the Hb cartridge* on page B-63.
Waste tubing	For instructions, see *Replacing the waste tube* on page B-77.
Check vacuum system	For instructions, see *Vacuum System* on page D-101.
VP tubing set	For instructions, see *Replacing the VP tube set* on page B-78.

The tubing paths must also be disinfected annually and the baro value must be checked.

cobas b 221<2/4/6> systems (COOX)

Yearly replacement

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste container, etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

Sample needle	For instructions, see *Replacing the needle* on page B-23.
Fill port	For instructions, see *Replacing the fill port* on page B-23.
T&D tubing set	For instructions, see *Replacing the T&D tubing set* on page B-27.
PP pump tube	For instructions, see *Replacing the pump tube* on page B-67.
Cuvette	For instructions, see *Replacing the cuvette* on page B-59.
Cuvette seals	For instructions, see *Replacing the cuvette seals* on page B-59.
Hemolyzer tube	For instructions, see *Replacing the Hemolyzer tube* on page B-61.
FMS tubing set	For instructions, see *Replacing the FMS tubing set* on page B-35.
Waste separator	For instructions, see *Replacing the waste separator* on page B-68.
Bypass nipple	For instructions, see *Replacing the bypass nipple* on page B-24.
Bacteria filter	For instructions, see *Replacing the bacteria filter* on page B-72.
Air filter	(On the rear panel of the instrument.)
T&D disk	For instructions, see *Replacing the T&D disk* on page B-26.
Check vacuum system	For instructions, see *Vacuum System* on page D-101.
Tubing set tHb/PolyOX	For instructions, see *Replacing the tubing set tHb/PolyOX* on page B-59.

The tubing paths must also be disinfected annually and the baro value must be checked.

Replace every three years

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste container, etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

Sample needle	For instructions, see *Replacing the needle* on page B-23.
Fill port	For instructions, see *Replacing the fill port* on page B-23.
T&D tubing set	For instructions, see *Replacing the T&D tubing set* on page B-27.
PP pump tube	For instructions, see *Replacing the pump tube* on page B-67.
Cuvette	For instructions, see *Replacing the cuvette* on page B-59.
Cuvette seals	For instructions, see *Replacing the cuvette seals* on page B-59.
Hemolyzer tube	For instructions, see *Replacing the Hemolyzer tube* on page B-61.
FMS tubing set	For instructions, see *Replacing the FMS tubing set* on page B-35.
Waste separator	For instructions, see *Replacing the waste separator* on page B-68.
Bypass nipple	For instructions, see *Replacing the bypass nipple* on page B-24.
Bacteria filter	For instructions, see *Replacing the bacteria filter* on page B-72.
Air filter	(On the rear panel of the instrument.)
T&D disk	For instructions, see *Replacing the T&D disk* on page B-26.
Tubing set tHb/PolyOX	For instructions, see *Replacing the tubing set tHb/PolyOX* on page B-59.
Sample distributor cartridge	For instructions, see *Replacing the sample distributor cartridge* on page B-35.
Measuring chamber cartridge	For instructions, see *Replacing the measuring chamber cartridge* on page B-48.
Hb cartridge	For instructions, see *Replacing the Hb cartridge* on page B-63.
Waste tubing	For instructions, see *Replacing the waste tube* on page B-77.
Check vacuum system	For instructions, see *Vacuum System* on page D-101.
VP tubing set	For instructions, see *Replacing the VP tube set* on page B-78.

The tubing paths must also be disinfected annually and the baro value must be checked.

AutoQC module

Yearly replacement

AQC maintenance kit

The AQC maintenance kit consists of the following components.

Tube for magnetic valve Replacement: remove the tube at the angle nipples and replace it with a new one.

Sample tube complete For instructions of the replacement, see *Replacing the AQC sample tube complete* on page B-129.

Wash port For instructions of the replacement, see *Replacing the wash port* on page B-135.

Troubleshooting D

7 Troubleshooting D-3

Troubleshooting

This chapter provides information about the troubleshooting of the **cobas b** 221 system. The system stops and the error messages are listed (sorted by Info No.). Explanation of important test routines will assist in locating error sources.

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Important Notes

Always check all cable and tube connections for the relevant component before starting disassembly! Serious error messages are frequently the result of loose or incorrectly attached cable and tube connections.

*Various components of the **cobas b** 221 system, such as T&D module, tubes, waste bottle, waste separator etc., contain liquid biological residues after use that may cause infection.*

Handle these components with care and avoid skin contact. To avoid direct contact with biological materials, always wear appropriate protective equipment such as lab clothing, protective gloves, safety glasses and, if necessary, a face mask. Additionally a face shield must be worn if there is a potential of a splashback. Appropriate disinfection and sterilization procedures must be followed.

Always wear gloves when working with the instrument! The tubes may drip a little after being disconnected. Remove excess fluids with a clean, absorbent cloth.

General information

MSS information

Starting from software version 5.00 MSS cartridges with sensor specific correction values can be installed. In order to verify that the MSS barcode was read in correctly, call up the following function:

☞ > [Versions].

The "MSS imprint" value is displayed and has to match the imprint on the MSS cartridge.

Hard disk information

Symbol	Description
	Rev. 4.X parts
	Rev. 4.X parts, Hitachi hard disk
	Rev. 4.X parts, Hitachi hard disk and bios update
	Rev. 4.X parts, Fujitsu hard disk

Figure D-1 Labeling of the new hard disk

Touch screen/PC units, interface units and rev. 4.X hard disks (production parts and spare parts) are labeled with a green dot (sticker).

Current rev. 4.X hard disks are produced by a different manufacturer (Fujitsu). New touch screen/PC units produced with a current rev. 4.X hard disk are labeled with a green dot (sticker) containing the letter "F". The capacity of the current rev. 4.X hard disk is 40 GB. As a difference to the other versions the hard disk LED on front of the touch screen/PC unit will be lit when there is no disk access with Hitachi hard disks and remains dark when there is disk access. This is the normal operation.

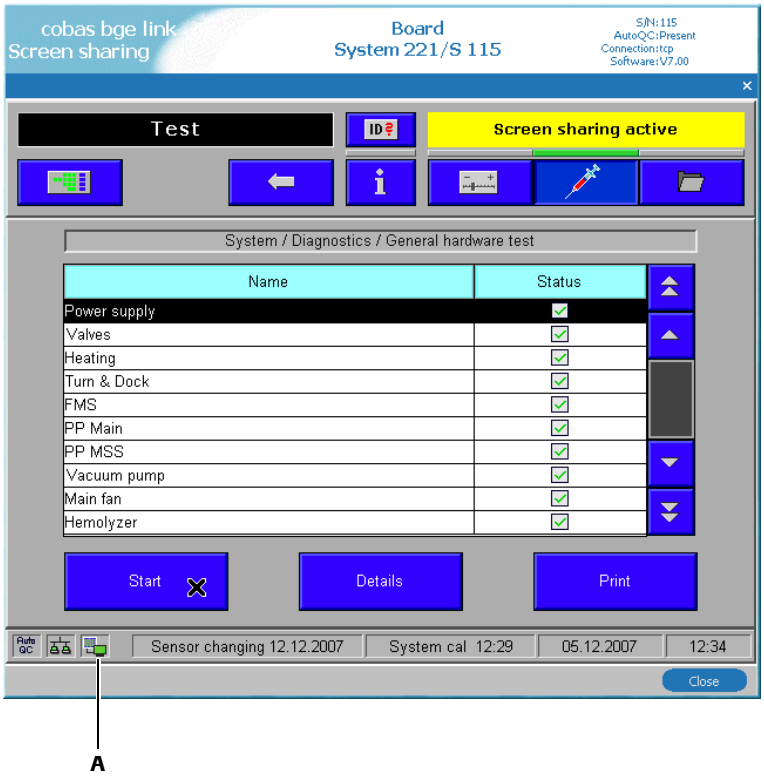
Fill level determination

Time to change The time to change is estimated based on the installation date (start date) of solutions and packs as well as the sample and calibration throughput of the last 14 days. When having low sample throughput the time to change can be limited by the on board time.

On board time The on-board time for solutions and packs is 42 days starting from software version 5.00 (28 days for earlier software versions).

cobas bge link screen sharing

Starting from software version 6.00 and **cobas** bge link version 3.5 a new screen sharing feature is available and allows for on-screen control of the **cobas b** 221 system. This allows to operate the instrument on a PC using **cobas** bge link.



A Screen sharing indicator

Figure D-2 **cobas** bge link screen sharing

cobas bge link also includes a feature for downloading the instrument log files to the PC.

For details, see the **cobas** bge link documentation.

System stops

Emergency routine

In case of a system stop, the emergency routine will initially be started after 50 minutes and then every 4 hours to prevent crystallizations in tubings, pipes and electrodes. This routine cannot be interrupted. In the process Mix1 is positioned into the BG and the ISE measuring chamber and MSS standby solution is positioned into the MSS measuring chamber.

- Resolve all system stops ([Info] > [List of all warnings]).

Error 10001 "Flap W"

The docking mechanism W is open.

- Check docking mechanism for waste again. Open and close several times.
- Replace docking mechanism for waste.

For instructions, see *Replacing the waste docking mechanism* on page B-69.

Error 10002 "Out of operation"

The instrument was taken out of operation.

- Perform installation procedures.

For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Introduction", section "Installation"*.

Error 10003 "Warmup"

The instrument warms up after replacement of electrodes, power-on or power fail.

- Wait until the warmup is finished and perform installation procedures if necessary.

For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Introduction", section "Installation"*.

Error 10004 "Economy mode"

The instrument is in automatic or manual economy mode.

- To return to the ready mode press [Exit].

Error 10005 "Comm. error PC-µC"

Communications between PC and microcontroller is interrupted.

- Turn the instrument off and on again.
- After replacing the Screen/PC-unit or the hard disk, assign the valid instrument type and load the default settings.

  For instructions, see *Instrument type* on page B-6.

Error 10006 "Download error"

The download process to the microcontroller failed.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Reinstall software.
- Replace the mainboard unit.

  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Check AQC/PolyOX cable for damage and replace if necessary.

Error 10008 "No waste container"

Waste container is missing.

- Insert container.

Error 10009 "Current overload actor bus"

A component on the actor bus has a short circuit.

- Call up general hardware test.

  If the general hardware tests interrupts at beginning:
- Replace power supply.

  For instructions, see step *2* of *Removing the rear panel* on page B-20.
- Visually check the actuator bus HS cable and all cable plugs.
- At the ready screen, press ☞ [System] > [Component test] > [Aggregates] or [Valves].
- Perform component tests for the following modules:
  - vacuum pump
  - peristaltic pumps
  - T&D module
  - hemolyzer
  - valves V13, V18, V19, VM

  If the system stop occurs when testing a specific module, replace the module.

Error 10010 "Current overload valve bus"

A component on the valve bus has a short circuit.

- Call up general hardware test.

  If the general hardware tests interrupts at beginning:

- Replace power supply.

  👁 For instructions, see step *2* of *Removing the rear panel* on page B-20.

- Visually check the valve bus cable and all cable plugs.
- At the ready screen, press ☞ [System] > [Component test] > [Valves].
- Perform component tests for all valves:
  - Perform "Load test": the valve is switched several times.
  - Perform "Switch": the valve position is changed.

  Note the switching noise of the valve and verify the switching optically if possible. If the system stop persists when testing a specific valve, replace the valve.

Error 10011 "Database not ready"

The database is not ready.

- Wait some minutes if the error occurs during warmup.
- Turn the instrument off, wait at least 3 minutes, and turn it back on.

Error 10012 "µC memory overrun"

A microcontroller memory overflow was detected.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.

Error 10016 "Bottle compartment cover open"

The bottle compartment cover is open.

- *If the bottle compartment cover is closed:* Check function of micro switch module (micro switch, cabling and plugs) and replace if necessary.

  👁 For instructions, see *Replacing the micro switch module* on page B-71.

Error 10017 "Bypass wash error 1"

Sample sensor SS2 recognizes too less air during the wash procedure.

- Call up "Wash" again.

  ☞ At the system stop screen, press [Wash].

- Clean the moisture trap at the T&D tubing.
- Replace the T&D tubing set.

  👁 For instructions, see *Replacing the T&D tubing set* on page B-27.

Error 10018 "SD wash error 1"

Sample sensor SS2 recognizes too less air during the wash procedure.

- Call up "Wash" again.

  ☞ At the system stop screen, press [Wash].
- Clean the moisture trap at the T&D tubing.
- Replace the T&D tubing set.

  👁 For instructions, see *Replacing the T&D tubing set* on page B-27.

Error 10019 "Waste container full"

The waste container is full.

- Insert empty waste container or enter correct fill level.

Error 10020 "Rinse bottle empty"

The transponder on the S1 Rinse Solution bottle indicates an empty bottle.

- Insert new S1 Rinse Solution.

Error 10021 "Flap S1"

The docking mechanism S1 is open.

- Check docking mechanism S1 again. Open and close several times.
- Replace docking mechanism S1.

  👁 For instructions, see *Replacing the docking mechanism S1 (rinse solution)* on page B-70.

Error 10022 "µC Reset"

Microcontroller reset.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.

Error 10023 "Power fail"

A power fail occured.

- The instrument will be ready for operation after warmup.

Error 10024 "No wash-water container"

No S1 Rinse Solution is installed or the transponder is damaged.

- Insert new S1 Rinse Solution.

Error 10025 "Check date and time"

Date and time have to be verified.

- Input current date and time.

Error 10026 "Bypass wash error 2"

Sample sensor SS2 recognizes too less S1 Rinse Solution during the wash procedure.

- Call up "Wash" again.
  ☞ At the system stop screen, press [Wash].
- Clean the water jet nozzle.
- Check waste tube and replace if necessary.
  👁 For instructions, see *Replacing the waste tube* on page B-77.
- Check sample inlet path and replace if necessary.
  👁 For instructions, see *Replacing the sample inlet path* on page B-24.
- Replace the T&D tubing set.
  👁 For instructions, see *Replacing the T&D tubing set* on page B-27.
- Insert new S1 Rinse Solution.

Error 10027 "SD wash error 2"

Sample sensor SS2 recognizes too less S1 Rinse Solution during the wash procedure.

- Call up "Wash" again.
  ☞ At the system stop screen, press [Wash].
- Clean the water jet nozzle.
- Check waste tube and replace if necessary.
  👁 For instructions, see *Replacing the waste tube* on page B-77.
- Check sample inlet path and replace if necessary.
  👁 For instructions, see *Replacing the sample inlet path* on page B-24.
- Replace the T&D tubing set.
  👁 For instructions, see *Replacing the T&D tubing set* on page B-27.
- Insert new S1 Rinse Solution.

Error 10028 "S1 on board time expired"

On-board time of S1 Rinse Solution expired.

- Insert new S1 Rinse Solution.

Error 10029 "S1 expired"

S1 Rinse Solution expired.

- Insert new S1 Rinse Solution.

Error 10032 "Microcontroller communications error"

A communications problem occurred at the microcontroller.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cabling between interface board and mainboard.

Error 10033 "COOX communications error"

A communications problem occurred between microcontroller and PolyOX-KX board.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cabling between PolyOX-KX board and interface board.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 10034 "AQC communications error"

A communications problem occurred between microcontroller and AQC board.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cabling between AQC board and interface board.
- Replace the AQC board.
  For instructions, see *Replacing the AQC board* on page B-124.

Error 10039 "Vacuum reduction not ok"

Vacuum could not be reduced, V13 did not open.

- Replace valve V13.
  For instructions, see *Replacing the waste valves V13/V18* on page B-85.
- Start vacuum pump test: if the pump output is more than 20 % over or under the reference value, the entire vacuum pump must be replaced.
  For instructions, see *Replacing the vacuum pump completely* on page B-73.

Error 10040 "Vacuum error"

Vacuum buildup is insufficient.

- Start vacuum pump test: if the pump output is more than 20 % over or under the reference value, the entire vacuum pump must be replaced.
  For instructions, see *Replacing the vacuum pump completely* on page B-73.
- Start general fluidics test: if there is a leak between the T&D module and the vacuum pump, it will be detected here. The relevant component must be replaced.

Error 10041 "Waste error 1"

The waste system is leaking.

- Insert new waste container.
- The waste docking mechanism is contaminated or damaged. It must be cleaned or replaced.

  For instructions, see *Replacing the waste docking mechanism* on page B-69.

Error 10042 "Waste error 2"

The waste ventilation path is blocked.

- The waste ventilation path is blocked. Insert new waste container.

Error 10043 "Separator sens. error"

The optical fluid sensor in the waste separator could not be calibrated.

- In the sensor test check the functioning of the waste container sensor and if necessary replace it.
- Replace the vacuum control board.

  For instructions, see *Replacing the vacuum control board* on page B-80.

Error 10044 "Separator error"

The fluid in the waste separator could not drain.

Too much sample injected, the waste separator is overfilled at the end of the measurement.

- Stop injection of the sample when acoustic signal or visual indication on the screen occurs.
- Insert new waste container.

Waste separator empty:

- In the sensor test check the functioning of the waste sensor and if necessary replace the waste sensor.

Waste separator full:

- Check waste system (valve, waste tube, waste container) for blockages and replace the relevant component.

Error 10045 "Check Waste fill level"

Measured waste fill level differs too much from calculated value.

- Check waste fill level and enter it correctly.

Error 10046 "Waste line blocked"

The connection from separator into the waste container is not continuous.

- Insert new waste container.

  Waste separator empty:

- In the sensor test check the functioning of the waste sensor and if necessary replace the waste sensor.

  Waste separator full:

- Check waste system (valve, waste tube, waste container) for blockages and replace the relevant component.
- Replace the vacuum control board.

  For instructions, see *Replacing the vacuum control board* on page B-80.

Error 10047 "VPS error"

The vacuum pump protection contains fluid. Vacuum buildup is not possible.

Vacuum pump protector full:

- Replace vacuum pump protector.

  For instructions, see *Replacing the vacuum pump protector* on page B-78.

  Vacuum pump protector empty:

- In the sensor test check the functioning of the VPS sensor and if necessary replace it.

  For instructions, see *Replacing the vacuum pump protector* on page B-78.
- Replace the vacuum control board.

  For instructions, see *Replacing the vacuum control board* on page B-80.

Error 10048 "Error SS1"

The optical sample sensor at the input of the BG module could not be calibrated.

- Call up "Wash" to calibrate the sample sensor.
- Check the corresponding sample sensor in the sensor test: press [Calibrate] to perform dry calibration. Then press [Inject bypass] / [Inject sample distributor] and inject water through the input unit. Press [Measure]. The measured value with liquid shoud be significantly lower than dry.
- Visually inspect the corresponding sample sensor for liquid residue.

  Fluid present:

  - Test corresponding valves and if necessary replace them.

    For instructions, see *Replacing the valves from sample distributor cartridge and Hb cartridge* on page B-83.
  - Check tubing system for blockages and replace the relevant components.

  No fluid present:

- Replace corresponding sample sensor.
  - For instructions, see *Replacing the SS1, SS2, SS3 and SS4 optical sensors* on page B-39.
- Replace sample sensor board.
  - For instructions, see *Replacing the sample sensor board* on page B-91.

Error 10049 "Error SS2"

The optical sample sensor at the end of the sample inlet path could not be calibrated.

- Call up "Wash" to calibrate the sample sensor.
- Check the corresponding sample sensor in the sensor test: press [Calibrate] to perform dry calibration. Then press [Inject bypass] / [Inject sample distributor] and inject water through the input unit. Press [Measure]. The measured value with liquid shoud be significantly lower than dry.
- Visually inspect the corresponding sample sensor for liquid residue.

  Fluid present:

  - Test corresponding valves and if necessary replace them.
    - For instructions, see *Replacing the valves from sample distributor cartridge and Hb cartridge* on page B-83.
  - Check tubing system for blockages and replace the relevant components.

  No fluid present:

  - Replace corresponding sample sensor.
    - For instructions, see *Replacing the SS1, SS2, SS3 and SS4 optical sensors* on page B-39.
  - Replace sample sensor board.
    - For instructions, see *Replacing the sample sensor board* on page B-91.

Error 10050 "Error SS3"

The optical sample sensor in the Hb cartridge could not be calibrated.

- Call up "Wash" to calibrate the sample sensor.
- Check the corresponding sample sensor in the sensor test: press [Calibrate] to perform dry calibration. Then press [Inject bypass] / [Inject sample distributor] and inject water through the input unit. Press [Measure]. The measured value with liquid shoud be significantly lower than dry.
- Visually inspect the corresponding sample sensor for liquid residue.

  Fluid present:

  - Test corresponding valves and if necessary replace them.
    - For instructions, see *Replacing the valves from sample distributor cartridge and Hb cartridge* on page B-83.
  - Check tubing system for blockages and replace the relevant components.

  No fluid present:

- Replace corresponding sample sensor.
  - For instructions, see *Replacing the SS1, SS2, SS3 and SS4 optical sensors* on page B-39.
- Replace sample sensor board.
  - For instructions, see *Replacing the sample sensor board* on page B-91.

Error 10051 "Error SS4"

The optical sample sensor at the input of the MSS module could not be calibrated.

- Call up "Wash" to calibrate the sample sensor.
- Check the corresponding sample sensor in the sensor test: press [Calibrate] to perform dry calibration. Then press [Inject bypass] / [Inject sample distributor] and inject water through the input unit. Press [Measure]. The measured value with liquid shoud be significantly lower than dry.
- Visually inspect the corresponding sample sensor for liquid residue.

  Fluid present:

  - Test corresponding valves and if necessary replace them.
    - For instructions, see *Replacing the valves from sample distributor cartridge and Hb cartridge* on page B-83.
  - Check tubing system for blockages and replace the relevant components.

  No fluid present:

  - Replace corresponding sample sensor.
    - For instructions, see *Replacing the SS1, SS2, SS3 and SS4 optical sensors* on page B-39.
  - Replace sample sensor board.
    - For instructions, see *Replacing the sample sensor board* on page B-91.

Error 10052 "Error SS6"

The optical sample sensor in the middle of the sample inlet path could not be calibrated.

- Check installation of sample inlet path.
- Call up "Wash" to calibrate the sample sensor.
- Check the corresponding sample sensor in the sensor test: press [Calibrate] to perform dry calibration. Then press [Inject bypass] / [Inject sample distributor] and inject water through the input unit. Press [Measure]. The measured value with liquid shoud be significantly lower than dry.
- Visually inspect the sample sensor for liquid residue.

  Fluid present:

  - Check tubing system for blockages and if necessary replace T&D tubing set.
    - For instructions, see *Replacing the T&D tubing set* on page B-27.

  No fluid present:

  - Replace sample sensor.
    - For instructions, see *Replacing the optical sensor SS6* on page B-25.

- Replace the T&D actuator board.
  For instructions, see *Replacing the T&D actuator board* on page B-30.

Error 10054 "Baro sensor error"

The measured barometric pressure falls outside the specified range.

- Update Baro value.
  For instructions, see *Baro sensor* on page D-101, *Baro settings* on page B-5.
- If the error persists, replace the vacuum control board.
  For instructions, see *Replacing the vacuum control board* on page B-80.

Errors 10056...10067 "Process Error + additional information"

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10088 "ADC Error"

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10089...10094 "Comm. error + additional information"

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.

- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10095...10097 "Timing error"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10098 "Timing error COOX measurement"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10099...10105 "Timing error"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10106 "Timing error"

An asynchronism occurred between processes and measuring (MSS).

- Check SD cartridge tubing.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Call up MSS contact path test with external sample for leak test and contact path test.
  👁 For instructions, see *Contact path test* on page D-95.
- Replace the MSS reference electrode (only for instruments with urea installed).
- Check MSS sensor for correct fit and replace if necessary.

Error 10107 "Timing error"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Replace the PolyOX-KX control board.
  👁 For instructions, see *Replacing the PolyOX-KX control board* on page B-53.
- Replace the interface unit.
  👁 For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10108...10112 "Timing error"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  👁 For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10113...10117 "Comm. error + additional information"

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.

- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10118...10119 "Timing error MSS"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10120...10121 "Timing error"

An asynchronism occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Errors 10123...10126 "Comm. error D cal."

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10127 "Timing error MSS"

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10128 "Timing error"

A subprogram did not report back.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10130 "Timing error COOX"

An asynchrony occurred between processes and measuring.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check AQC/PolyOX cable for damage and replace if necessary.
- Check connector cable between mainboard and interface unit.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.
- Replace the interface unit.
  For instructions, see *Replacing the Interface unit* on page B-92.

Error 10152 "Measuring chamber cover BG open"

The measuring chamber cover BG is open. In case of closed measuring chamber cover with displayed "Changing of BG electrodes" screen:

- Check all cable plug connectors on the BG measuring chamber
- Replace BG measuring chamber.
  For instructions, see *Replacing the BG measuring chamber* on page B-40.

Error 10153 "Measuring chamber cover ISE open"

The measuring chamber cover ISE is open. In case of closed measuring chamber cover with displayed "Changing of ISE electrodes" screen:

- Check all cable plug connectors on the ISE measuring chamber
- Replace ISE measuring chamber.
  For instructions, see *Replacing the ISE measuring chamber* on page B-42.

Error 10154 "Measuring chamber cover MSS open"

The measuring chamber cover MSS is open. In case of closed measuring chamber cover with displayed "Changing of MSS sensors" screen:

- Check all cable plug connectors on the MSS measuring chamber
- Replace MSS measuring chamber.
  For instructions, see *Replacing the MSS measuring chamber* on page B-44.

Error 10155 "AQC drawer open"

The AutoQC drawer cover is open. In case of closed AutoQC drawer cover with displayed "Mat change" screen:

- Check all plug connectors on the AQC board.
- Check the AQC snap lock.
  For instructions, see *Replacing the AQC snap lock* on page B-122.

Errors 10160...10261 "File error"

A file check resulted in an error.

- Reinstall software.
  For instructions, see *Software update* on page B-104.
- Replace the hard disk.
  For instructions, see *Replacing the hard disk* on page B-99.

Error 10288 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check all plug connectors to the MC Actor Control Board.
  For instructions, see *Replacing the MC Actor Control Board* on page B-50.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Errors 10291...10294 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Errors 10299, 10300 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Error 10301 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the MC Actor Control Board.
  For instructions, see *Replacing the MC Actor Control Board* on page B-50.

Error 10302 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the Actuator Board V4/V6.
  For instructions, see *Replacing the Actuator Board V4/V6* on page B-80.

Errors 10303...10310 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the MC Actor Control Board.
  For instructions, see *Replacing the MC Actor Control Board* on page B-50.

Errors 10318...10327 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Error 10340 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the T&D actuator board.
  For instructions, see *Replacing the T&D actuator board* on page B-30.

Errors 10341, 10342 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10343 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the vacuum control board.
  For instructions, see *Replacing the vacuum control board* on page B-80.

Error 10346 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the HSIN board.
  For instructions, see *Replacing the HSIN board* on page B-61.

Error 10347 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10348 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the BG measuring chamber.
  For instructions, see *Replacing the BG measuring chamber* on page B-40.

Error 10349 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the ISE measuring chamber.
  For instructions, see *Replacing the ISE measuring chamber* on page B-42.

Error 10350 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the MSS measuring chamber.
  For instructions, see *Replacing the MSS measuring chamber* on page B-44.

Error 10351 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Error 10352 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the FMS control board.
  For instructions, see *Replacing the FMS control board* on page B-35.

Errors 10353, 10388 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace touch screen/PC unit.
  For instructions, see *Replacing the touch screen/PC unit* on page B-95.

Error 10389 "Program error"

A communications error occurred as part of the programming of the module processors.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the printer.
  For instructions, see *Replacing the Printer* on page B-108.

Errors 10416...10419 "Hardware conflict"

A defective module was detected within the scope of the module communications.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Errors 10424...10426 "Hardware error"

A defective module was detected within the scope of the module communications.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10427 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the T&D actuator board.
  For instructions, see *Replacing the T&D actuator board* on page B-30.

Errors 10428, 10429 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10430 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the vacuum control board.
  For instructions, see *Replacing the vacuum control board* on page B-80.

Error 10431 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10433 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the HSIN board.
  For instructions, see *Replacing the HSIN board* on page B-61.

Error 10434 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10435 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the BG measuring chamber.
  For instructions, see *Replacing the BG measuring chamber* on page B-40.

Error 10436 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the ISE measuring chamber.
  For instructions, see *Replacing the ISE measuring chamber* on page B-42.

Error 10437 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the MSS measuring chamber.
  For instructions, see *Replacing the MSS measuring chamber* on page B-44.

Error 10438 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Error 10439 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the FMS control board.
  For instructions, see *Replacing the FMS control board* on page B-35.

Error 10440 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the touch screen/PC unit.
  For instructions, see *Replacing the touch screen/PC unit* on page B-95.

Errors 10441, 10442 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Error 10443 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the MC Actor Control Board.
  For instructions, see *Replacing the MC Actor Control Board* on page B-50.

Error 10444 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the Actuator Board V4/V6.
  For instructions, see *Replacing the Actuator Board V4/V6* on page B-80.

Errors 10445...10448 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the MC Actor Control Board.
  For instructions, see *Replacing the MC Actor Control Board* on page B-50.

Errors 10449...10452 "Hardware error"

A defective module was detected within the scope of the module communications.

- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Errors 10456...10467 "EEPROM error"

The EEPROM data of a module processor are incorrect.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the sample distributor.
  For instructions, see *Replacing the sample distributor* on page B-37.

Error 10468 "EEPROM error"

The EEPROM data of a module processor are incorrect.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the FMS control board.
  For instructions, see *Replacing the FMS control board* on page B-35.

Error 10469 "Vacuum ADC error"

A communications problem occurred at the vacuum board.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the vacuum control board.
  For instructions, see *Replacing the vacuum control board* on page B-80.

Error 10470 "Transponder error"

An antenna of the transponder receiving circuit is defective.

- Remove and replace waste bottle, S1 rinse solution, S2 and S3 fluid pack.
- Check all cable plug connectors of the transponder antennas.
- Replace the Transponder Control waste, S1, S2 or S3.
  For instructions, see *Replacing the Transponder Control (waste, S1, S2, S3)* on page B-72.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10471 "T&D error"

An error occurred at the T&D module.

- Press "Initialization".
- T&D disk, fill port or plug control are very contaminated or damaged. Clean the relevant components or if necessary replace.
- Replace the T&D module.
  For instructions, see *Replacing the T&D module* on page B-21.

Error 10472 "Transponder error S1"

The transponder data of the rinse bottle could not be read.

- Pull out S1 Rinse Solution and put it back in.
- Insert new S1 Rinse Solution.
- Check all cable plug connectors of the transponder antennas.
- Replace the transponder control S1.
  For instructions, see *Replacing the Transponder Control (waste, S1, S2, S3)* on page B-72.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 10488 "HW test error"

An error was recognized in a hardware component, the general hardware test could not be completed.

- Call up General hardware test again and replace damaged parts.
  For instructions, see *General hardware test* on page D-127.

Message 10489 "Remote lock"

Instrument locked by **cobas** bge link.

- To remove this lock press "Continue". Log on as a user with the privileg "Remote unlock".

  👁 For more information on user management, refer to the **cobas b** 221 system *Reference Manual, Chapter "Software modes", section "Security"*.

Message 10491 "QC setup wizard active"

The QC setup wizard has been started.

- When the QC setup wizard is finished, this message will be removed.

  👁 For more information, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Quality control", section "QC setup wizard"*.

Message 10492 "Data transfer active"

The instrument was locked by starting a data transfer (**cobas** bge link log file download).

- This lock will be removed after the data transfer was finished.

  👁 For more information, refer to the **cobas** bge link documentation.

Module stops

Error 20000 "SD temp. nOk"

The temperature of the sample distributor falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the SD connector cable on the mainboard for damage.

  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Call up component test and check the SD temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures SD BG/ISE] / [Temperatures SD MSS].

  All SD temperatures not ok – ☒

  ◦ Replace power supply.

    👁 For instructions, see *Removing the rear panel* on page B-20.

  SD temperatures partly not ok – ☒

  ◦ Replace sample distributor.

    👁 For instructions, see *Replacing the sample distributor* on page B-37.

Error 20016 "FMS volume error"

The calibration solution is not aspirated into the BG measuring chamber in the specified time.

- Aspirate CAL B.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Call up the "Mixing system" calibration after correcting any errors.
  ☞ [System] > [Calibrations] > [Mixing system] > [Start].
- Install a new S2 Fluid Pack.
- Replace pump tube of main pump.
  👁 For instructions, see *Replacing the pump tube* on page B-67.
- Test functioning of the BG measuring chamber by using the electrode simulator:

  Simulator test ok:

  - Replace SCon.
  - Replace fluid mixing system.
    👁 For instructions, see *Replacing the FMS* on page B-33.

  Simulator test not ok:

  - See next item.
- Test functioning of the ISE measuring chamber by electrode simulator:

  Simulator test ok:

  - Replace BG measuring chamber.
    👁 For instructions, see *Replacing the BG measuring chamber* on page B-40.

  Simulator test not ok:

  - Replace mainboard unit.
    👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20017 "FMS error"

The mixture ratio falls outside the specified range.

- Aspirate CAL A and CAL B.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Install a new S2 Fluid Pack after correcting any errors.

- Use fluid actions to aspirate CAL A and CAL B again.

  Evaluation ok:

  ◦ Replace FMS control board.

  For instructions, see *Replacing the FMS control board* on page B-35.

  ◦ Replace the fluid mixing system.

  For instructions, see *Replacing the FMS* on page B-33.

  If these actions cannot correct the errors, see the next item.

  Evaluation not ok:

  ◦ Check tubing paths for CAL A and CAL B for blockages and replace the relevant component.

Error 20018 "Pack S2 empty"

S2 Fluid Pack is empty.

- Install a new S2 Fluid Pack.
- If the error persists, download service log file and send instrument for repair.

  For instructions, see *Service log file export* on page B-12.

Error 20019 "Flap S2"

The docking mechanism S2 is open.

- Check docking mechanism S2 again. Open and close several times.
- Replace docking mechanism S2.

  For instructions, see *Replacing the docking mechanisms S2 and S3 (fluid packs)* on page B-70.

Error 20020 "No pack S2"

S2 Fluid Pack is missing.

- Check plug connectors of the transponder antenna cable.
- Replace transponder control S2.

  For instructions, see *Replacing the Transponder Control (waste, S1, S2, S3)* on page B-72.

- If a "Transponder Error" (*Error 20022 "Transponder error S2"* on page D-40, *Error 20094 "Transponder error S3"* on page D-47) occurs simultaneously with this error, replace mainboard unit.

  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20021 "ADC error cond BG/ISE"

A hardware error occurred during mixture calibration

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the mainboard unit.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20022 "Transponder error S2"

The transponder data of S2 Fluid Pack could not be read.

- Remove and replace S2 Fluid Pack.
- Check plug connectors of the transponder antenna cable.
- Replace transponder control S2.
  👁 For instructions, see *Replacing the Transponder Control (waste, S1, S2, S3)* on page B-72.
- If multiple "Transponder Errors" (*Error 20022 "Transponder error S2"* on page D-40, *Error 20094 "Transponder error S3"* on page D-47) occur simultaneously, replace mainboard unit.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20023 "S2 on board time expired"

On-board time of S2 Fluid Pack expired.

- Insert new S2 Fluid Pack.

Error 20024 "HW test error FMS"

A hardware error occurred during testing the FMS.

- Call up General hardware test and replace damaged parts.
  ☞ [System] > [Diagnostics] > [General hardware test].

Errors 20032...20034 "BG temperature nOk"

The temperature of the BG measuring chamber falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Call up component test and check the BG temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures BG].

  BG temperatures not ok – ☒

  - Replace BG measuring chamber.
    👁 For instructions, see *Replacing the BG measuring chamber* on page B-40.

- Check cable press fit of the BG connector cable on the mainboard for damage.
  For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20035 "BG temperature nOk"

The temperature of the BG measuring chamber falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Call up component test and check the BG temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures BG].

  BG temperatures not ok – ☒
  - Replace the BG sensor contact (SCon).
  - Replace BG measuring chamber.
    For instructions, see *Replacing the BG measuring chamber* on page B-40.
  - Replace the mainboard unit.
    For instructions, see *Replacing the Mainboard unit* on page B-89.
- Check cable press fit of the BG connector cable on the mainboard for damage.
  For details, see Figure *Mainboard connectors* on page B-90.
- Call up general hardware test to check function of fan unit and if necessary replace
  ☞ [System] > [Diagnostics] > [General hardware test].
  For instructions, see *Replacing the main fan unit* on page B-110.

Error 20037 "ADC error BG"

Signal acquisition could not be performed due to a hardware error.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the BG connector cable on the mainboard for damage.
- Replace the BG measuring chamber.
  For instructions, see *Replacing the BG measuring chamber* on page B-40.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20038 "HW test error BG"

A hardware error occurred during testing the BG measuring chamber.

- Call up General hardware test and replace damaged parts.
  ☞ [System] > [Diagnostics] > [General hardware test].

Errors 20048...20050 "ISE temperature nOk"

The temperature of the ISE measuring chamber falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Call up component test and check the ISE temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures ISE].

  ISE temperatures not ok – ☒

  - Replace ISE measuring chamber.

    👁 For instructions, see *Replacing the ISE measuring chamber* on page B-42.
- Check cable press fit of the ISE connector cable on the mainboard for damage.

  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.

  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20051 "ISE temperature nOk"

The temperature of the ISE measuring chamber falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the ISE connector cable on the mainboard for damage.

  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Call up component test and check the ISE temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures ISE].

  ISE temperatures not ok – ☒

  - Replace ISE measuring chamber.

    👁 For instructions, see *Replacing the ISE measuring chamber* on page B-42.
  - Replace the ISE sensor contact (SCon).
  - Replace the mainboard unit.

    👁 For instructions, see *Replacing the Mainboard unit* on page B-89.
- Call up general hardware test to check function of fan unit and if necessary replace ☞ [System] > [Diagnostics] > [General hardware test].

  👁 For instructions, see *Replacing the main fan unit* on page B-110.

Error 20053 "ADC error ISE"

Signal acquisition could not be performed due to a hardware error.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the ISE connector cable on the mainboard for damage.
- Replace the ISE measuring chamber.

  👁 For instructions, see *Replacing the ISE measuring chamber* on page B-42.

- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20054 "HW test error ISE"

A hardware error occurred during testing the ISE measuring chamber.

- Call up General hardware test and replace damaged parts.
  ☞ [System] > [Diagnostics] > [General hardware test].

Error 20065 "COOX lamp error"

An error occurred during control of the halogen lamp.

- Call up polychromator calibration.
- Replace the lamp unit Bilirubin.
  For instructions, see *Replacing the lamp unit bilirubin* on page B-51.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 20066 "COOX lamp error"

An error occurred when attempting to control/switch on the neon lamp during a measurement or polychromator calibration.

- Call up polychromator calibration.
- Replace the lamp unit Bilirubin.
  For instructions, see *Replacing the lamp unit bilirubin* on page B-51.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 20067 "COOX lamp error"

An error occurred when attempting to control/switch on the halogen lamp during a measurement or polychromator calibration.

- Call up polychromator calibration.
- Replace the lamp unit Bilirubin.
  For instructions, see *Replacing the lamp unit bilirubin* on page B-51.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 20068 "COOX HW error"

The signal acquisition could not be performed due to a hardware error.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.

- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 20069 "COOX HW error"

The supply voltage of the COOX module falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 20071 "COOX HW error"

A communications problem occurred at the microcontroller of the COOX module.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Replace the Polychromator Bilirubin.
  For instructions, see *Replacing the Polychromator Bilirubin* on page B-54.
- Replace the PolyOX-KX control board.
  For instructions, see *Replacing the PolyOX-KX control board* on page B-53.

Error 20072 "COOX temperature nOk"

The temperature of the cuvette holder falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the COOX connector cable on the mainboard for damage.
  For details, see Figure *Mainboard connectors* on page B-90.
- Call up component test and check the COOX temperature.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures COOX].

  COOX temperature not ok – ☒

  - Replace the cuvette holder.
    For instructions, see *Replacing the cuvette holder* on page B-58.
  - Replace the HSIN board.
    For instructions, see *Replacing the HSIN board* on page B-61.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20073 "HW test error Hemolyzer"

An error was recognized in a hardware component of the Hemolyzer.

- Verify drying of the hemolyzer tubing visually.
- Perform vacuum system test.
  For instructions, see *Vacuum System* on page D-101.

- Call up General hardware test and replace damaged parts.
  ☞ [System] > [Diagnostics] > [General hardware test].

Error 20080 "PP error"

The pump performance of the MSS output pump falls outside the specified range.

- To correct errors replace tubing at the MSS output pump and call up MSS system calibration.
- Replace pump head of MSS output pump.
  👁 For instructions, see *Replacing the pump head* on page B-66.
- Replace MSS output pump.
  👁 For instructions, see *Replacing a peristaltic pump* on page B-64.
- Replace the mainboard unit.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20081 "MSS pol. running"

The MSS polarization phase is not finished yet.

- The sensor will be operational after the system calibration which is automatically performed.

Error 20082 "MSS pol. not ok"

The blood sample required for MSS polarization could not be positioned.

- Repeat MSS polarization.
- Replace the MSS measuring chamber.
  👁 For instructions, see *Replacing the MSS measuring chamber* on page B-44.
- Check SS1 to SS4 sample sensors in the sensor test and if necessary calibrate by calling up "Wash".
- Check SS1 to SS4 sample sensors visually for fluid residues.

  Fluid present:

  - Test corresponding valves and if necessary replace them.
    👁 For instructions, see *Replacing the valves from sample distributor cartridge and Hb cartridge* on page B-83.
  - Check tubing system for blockages and replace the relevant components.

  No fluid present:

  - Replace corresponding sample sensor.
    👁 For instructions, see *Replacing the SS1, SS2, SS3 and SS4 optical sensors* on page B-39.
  - Replace sample sensor board.
    👁 For instructions, see *Replacing the sample sensor board* on page B-91.

Error 20083 "MSS pol. not ok"

The MSS polarization was canceled.

- Repeat MSS polarization.

Error 20084 "HW test error MSS"

An error was recognized in a hardware component of the MSS measuring chamber.

- Call up General hardware test and replace damaged parts.
  ☞ [System] > [Diagnostics] > [General hardware test].

Error 20085 "Pack S3 empty"

S3 Fluid Pack A is empty.

- Install a new S3 Fluid Pack A.
- If the error persists, download service log file and send instrument for repair.
  👁 For instructions, see *Service log file export* on page B-12.

Error 20086 "Flap S3"

The docking mechanism S3 is open.

- Check docking mechanism S3 again. Open and close several times.
- Replace docking mechanism S3.
  👁 For instructions, see *Replacing the docking mechanisms S2 and S3 (fluid packs)* on page B-70.

Errors 20087...20089 "MSS temperature nOk"

The temperature of the MSS measuring chamber falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Call up component test and check the MSS temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures MSS].

  MSS temperatures not ok – ☒

  - Replace MSS measuring chamber.
    👁 For instructions, see *Replacing the MSS measuring chamber* on page B-44.
- Check cable press fit of the MSS connector cable on the mainboard for damage.
  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20091 "No pack S3"

S3 Fluid Pack is missing.

- Check plug connectors of the transponder antenna cable.
- Replace transponder control S3.
  For instructions, see *Replacing the Transponder Control (waste, S1, S2, S3)* on page B-72.
- If a "Transponder Error" (*Error 20022 "Transponder error S2"* on page D-40, *Error 20094 "Transponder error S3"* on page D-47) occurs simultaneously with this error, replace mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20092 "ADC error MSS"

A hardware error occurred during initialization.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the MSS connector cable on the mainboard for damage.
- Replace the MSS measuring chamber.
  For instructions, see *Replacing the MSS measuring chamber* on page B-44.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20093 "ADC error MSS"

Signal acquisition could not be performed due to a hardware error.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the MSS connector cable on the mainboard for damage.
- Replace the MSS measuring chamber.
  For instructions, see *Replacing the MSS measuring chamber* on page B-44.
- Replace the mainboard unit.
  For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20094 "Transponder error S3"

The transponder data of S3 Fluid Pack A could not be read.

- Remove and replace S2 Fluid Pack A.
- Check plug connectors of the transponder antenna cable.
- Replace transponder control S3.
  For instructions, see *Replacing the Transponder Control (waste, S1, S2, S3)* on page B-72.

- If multiple "Transponder Errors" (*Error 20022 "Transponder error S2"* on page D-40, *Error 20094 "Transponder error S3"* on page D-47) occur simultaneously, replace mainboard unit.
- For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20095 "S3 on board time expired"

On-board time of S3 Fluid Pack A expired.

- Insert new S3 Fluid Pack A.

Error 20096 "tHb/SO_2 temperature nOk"

The temperature of the tHb/SO_2 module falls outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Verify if the tHb/SO_2 heating unit is installed correctly.
- Call up component test and check the tHb/SO_2 temperatures.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperatures tHb/SO_2].

  tHb/SO_2 temperature not ok – ☒

  - Replace tHb/SO_2 module.

    👁 For instructions, see *Replacing the tHb/SO_2 module* on page B-62.
- Check cable press fit of the tHb/SO_2 connector cable on the mainboard for damage.

  👁 For details, see Figure *Mainboard connectors* on page B-90.
- Replace the mainboard unit.

  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20097 "ADC error tHb"

Signal acquisition could not be performed due to a hardware error.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the tHb/SO_2 connector cable on the mainboard for damage.
- Replace the tHb/SO_2 module.

  👁 For instructions, see *Replacing the tHb/SO_2 module* on page B-62.
- Replace the mainboard unit.

  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20098 "tHb/SO_2 module not ready"

The tHb/SO_2 module is not ready.

- Replace the tHb/SO_2 module.
  👁 For instructions, see *Replacing the tHb/SO_2 module* on page B-62.

Error 20112 "SS5 error"

- Call up "Wash AutoQC".
- Check SS5 sample sensor in the sensor test and if necessary calibrate by calling up "Wash".
- Visually inspect the sample sensor for fluid residue.

  Fluid present:

  ◦ Check tubing system for blockage and replace relevant components.

  No fluid present:

  ◦ Replace Z-distributor board.
  👁 For instructions, see *Replacing the Z distributor board* on page B-126.
- Replace the mainboard unit.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Error 20113 "module error AQC"

The required XY position was not reached.

- Call up "Wash AutoQC".
  ☞ [System] > [Wash & cleaning] > [Wash AutoQC].
- Check all plug connectors on the AQC board.
- Replace the AQC board.
  👁 For instructions, see *Replacing the AQC board* on page B-124.

Error 20114 "module error AQC"

The required Z position was not reached.

- Call up "Wash AutoQC".
  ☞ [System] > [Wash & cleaning] > [Wash AutoQC].
- Check all plug connectors on the AQC board.
- Replace the AQC board.
  👁 For instructions, see *Replacing the AQC board* on page B-124.

Errors 20115...20118 "module error AQC"

The required position was not reached.

- Call up "Wash AutoQC".
  ☞ [System] > [Wash & cleaning] > [Wash AutoQC].
- Check all plug connectors on the AQC board.
- Replace the AQC board.
  👁 For instructions, see *Replacing the AQC board* on page B-124.

Error 20120 "AQC wash error"

The SS2 detects a bad wash profile of the AQC sample line.

- Call up "wash AQC" and visually check whether a water-air mixture is being aspirated through the wash tube.

  Water only:

  ◦ Wash nozzle is blocked; clean or replace nozzle.

  Air only:

  ◦ Check function of AQC motors and if necessary replace them.
- Check wash port for damage and if necessary replace it.
  👁 For instructions, see *Replacing the wash port* on page B-135.
- Check AQC needle for damage or blockage and if necessary replace it.
  👁 For instructions, see *Replacing the AutoQC steel tube* on page B-133.
- Replace the T&D disk.
  👁 For instructions, see *Replacing the T&D disk* on page B-26.

Errors 20122...20141 "AQC pos. error"

The required position was not reached.

- Call up "Wash AutoQC".
  ☞ [System] > [Wash & cleaning] > [Wash AutoQC].
- Check function of AQC motors and if necessary replace them.
  ☞ [System] > [Component test] > [Aggregates] > [AutoQC motors].

Error 20142 "AQC temperature nOk"

The temperature of the AQC module is outside the specified range.

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Call up component test and check the AQC temperature.

  ☞ [System] > [Component test] > [Control sensors] > [Temperature control] > [Temperature AQC].

  AQC temperature not ok – ☒

  ◦ Replace temperature sensor.

  👁 For instructions, see *Replacing the AQC temperature sensor* on page B-134.
- Replace the AQC board.

  👁 For instructions, see *Replacing the AQC board* on page B-124.

System warnings

Warning 30005 "Cl electrode is contaminated (defective)"

The Cl electrode is contaminated or defective.

- Call up "Start internal cleaning" for the ISE measuring chamber.
- Call up "Start external cleaning" for the ISE measuring chamber.
- Shorten the ISE cleaning interval.
  ☞ [Setup] > [Times & intervals] > [Maintenance timing] > [ISE cleaning].
- Clean the electrode using the "Cleaning Kit for Cl^- Electrode".

  👁 For instructions, refer to the "Cleaning Kit for Cl– Electrode" package insert.
- Replace Cl^- electrode.

This troubleshooting has also to be performed before deactivating this parameter and replacing it with a dummy electrode.

Warning 30008 "Pack S2 level is low"

S2 Fluid Pack will be empty in the next 12 to 24 hours.

- If necessary, insert a new S2 Fluid Pack.

  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Exchange of solutions and packs"*.

Warning 30009 "Pack S3 level is low"

S3 Fluid Pack A will be empty in the next 12 to 24 hours.

- If necessary, insert a new S3 Fluid Pack A.

  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Exchange of solutions and packs"*.

Warning 30010 "Rinse level is low"

S1 Rinse Solution will be empty in the next 12 to 24 hours.

- If necessary, insert a new S1 Rinse Solution.
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Exchange of solutions and packs"*.

Warning 30011 "Waste is nearly full"

The wastewater bottle will be full in the next 12 to 24 hours.

- If necessary, replace or empty the waste container.
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Exchange of solutions and packs"*.

Warning 30012 "Prep. of rinse not ok"

The fill routine for S1 Rinse Solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate rinse].
- Check tubing of AutoQC (even if no AutoQC module is installed), T&D tubing set and input unit.
- Check sample distributor tubing.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Insert new S1 Rinse Solution.
- Perform vacuum system test.
  👁 For instructions, see *Vacuum System* on page D-101.
- Perform sample sensor test (SS2).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30013 "Prep. of CAL B not ok"

The fill routine for CAL B was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL B].
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Check FMS tubing.
  👁 For instructions, see *Fluid mixing system (FMS)* on page B-33.
- Check sample distributor tubing.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Insert new S2 Fluid Pack.

- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.
- Perform sample sensor test (SS1).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30014 "Prep. of CAL A not ok"

The fill routine for CAL A was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL A].
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Check FMS tubing.
  👁 For instructions, see *Fluid mixing system (FMS)* on page B-33.
- Check sample distributor tubing.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Insert new S2 Fluid Pack.
- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.
- Perform sample sensor test (SS1).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30015 "Prep. of Ref. BG not ok"

The fill routine for BG reference solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Fill ref. electrode BG].
- Check MC cartridge tubing.
  👁 For instructions, see *Measuring chamber cartridge* on page B-48.
- Check S2 docking mechanism.
- Insert new S2 Fluid Pack.
- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.

Warning 30016 "Prep. of Ref. ISE not ok"

The fill routine for ISE reference solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Fill ref. electrode ISE].
- Check MC cartridge tubing.
  👁 For instructions, see *Measuring chamber cartridge* on page B-48.

- Check S2 docking mechanism.
- Insert new S2 Fluid Pack.
- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.

Warning 30017 "Prep. of O2 zero not ok"

The fill routine for O_2 zero point solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate solution O2 zero].
- Check T&D tubing set and input unit.
- Check S2 docking mechanism.
- Insert new S2 Fluid Pack.
- Perform vacuum system test.
  👁 For instructions, see *Vacuum System* on page D-101.
- Perform sample sensor test (SS2).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30018 "Prep. of Na cond. not ok"

The fill routine for Na conditioning solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate Na cond solution].
- Check T&D tubing set and input unit.
- Check S2 docking mechanism.
- Insert new S2 Fluid Pack.
- Perform vacuum system test.
  👁 For instructions, see *Vacuum System* on page D-101.
- Perform sample sensor test (SS2).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30019 "Prep. of clean. sol. not ok"

The fill routine for cleaning solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate clean. sol.].
- Check T&D tubing set and input unit.
- Check S2 docking mechanism.
- Insert new S2 Fluid Pack.
- Perform vacuum system test.
  👁 For instructions, see *Vacuum System* on page D-101.

- Perform sample sensor test (SS2).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30020 "Prep. of standby not ok"

The fill routine for MSS standby solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate standby solution].
- Check SD cartridge tubing.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Check MSS sensor for correct fit.
- Call up MSS contact path test with external sample for leak test and contact path test.
  👁 For instructions, see *Contact path test* on page D-95.
- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.
- Check S3 docking mechanism.
- Insert new S3 Fluid Pack A.

Warning 30021 "Prep. of Ref. MSS not ok"

Only for instruments with urea installed: The fill routine for MSS reference solution was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Fill ref. electrode MSS].
- Check instrument type and associated electrode configuration.
  ☞ [Setup] > [Protected setup] > [Instrument type].
- Check MC cartridge tubing.
  👁 For instructions, see *Measuring chamber cartridge* on page B-48.
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.
- Check S3 docking mechanism.
- Insert new S3 Fluid Pack A.

Warning 30022 "Prep. of CAL 1 not ok"

The fill routine for CAL 1 was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL 1].
- Check SD cartridge tubing.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Call up the general fluidics test.
  ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform general hardware test to test the valves.
  👁 For instructions, see *General hardware test* on page D-127.
- Check S3 docking mechanism.
- Insert new S3 Fluid Pack A.
- Perform sample sensor test (SS4).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warnings 30023...30025 "Prep. of CAL # not ok"

The fill routine for CAL 2, CAL 3 or CAL 4 was not ok.

👁 For details, see diagrams in Chapter 2 *Fluid actions*.

- Call up fill routine again.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL #].
- Check T&D tubing set and input unit.
- Check S3 docking mechanism.
- Insert new S3 Fluid Pack A.
- Perform vacuum system test.
  👁 For instructions, see *Vacuum System* on page D-101.
- Perform sample sensor test (SS2).
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].

Warning 30028 "Check AQC material"

At least 1 mat in the AutoQC module contains only two (or less) full ampoules.

- If necessary, insert a new mat.
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Changing of AutoQC mats*".

Warning 30029 "Check parameter status"

One or more parameters are not calibrated.

- To correct the error perform "Calibration for Ready":
  ☞ [System] > [Calibrations] > [Calibration for Ready].

Warning 30030 "Perform man. QC measurement"

Manual QC measurement is pending. Only with AutoQC: No QC measurement could be performed with the AutoQC module.

- Check AutoQC module.
  👁 For instructions, see *AutoQC module* on page B-117.
- Perform QC measurement manually.

Warning 30031 "Perform maintenance"

One or more maintenance procedures must be carried out.

- Perform the maintenance preocedure.
  ☞ [System] > [Utilities] > [Maintenance] > Maintenance procedure > [Do].
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance"*.

Warning 30032 "Printer – Lever open"

The printer lever is open.

- Close printer lever.
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Replacing printer paper"*.
- Check printer connector cable.
- Replace printer.
  👁 For instructions, see *Replacing the Printer* on page B-108.

Warning 30033 "Printer – Paper empty"

No printer paper is available.

- Insert printer paper.
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance", section "Replacing printer paper"*.
- Check printer connector cable.
- Replace printer.
  👁 For instructions, see *Replacing the Printer* on page B-108.

Warning 30034 "HW test error fan"

An error occured at the fan unit during the general hardware test

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Perform general hardware test to test fan unit (main fan).
  👁 For instructions, see *General hardware test* on page D-127.
- Replace the fan unit.
  👁 For instructions, see *Replacing the main fan unit* on page B-110.

Warning 30037 "Screen sharing active"

A service connection was established to the instrument. An indicator will be displayed in the status line.

- This warning will be removed after screen sharing was finished.

👁 For more information, see Figure D-2 on page D-12 and refer to the **cobas** bge link documentation.

Value flags

... check Hct result

The Hct measurement result is not plausible.

Possible causes: Since Hct is measured based on a conductivity measurement, the total ionic strength (total concentration of ions) can influence the Hct result. Deviating ISE concentrations could cause a deviation from the typical total ionic strength.

Remedy: Check sample material.

Flag no. 1000 "Sample pos. error (1)"

No constant conductivity over the distance MCI-MCO when positioning in the measuring chamber.

Possible causes:
- Blockage or leakage
- Leaky electrodes
- Solution is fragmented
- Solution is unhomogenous
- Separation of electrode membrane

Remedy:
- If discoloration can be detected by sample material in the internal electrolyte of the electrode, it must be replaced.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Call up "Contact path test" and aspirate CAL B.

👁 For the details, see *Contact path test* on page D-95.

- Insert electrode simulator in the relevant module and act accordingly.

Flag no. 1001 "Sample pos. error (2)"

Conductivity over the distance MCI-MCO too low when positioning in the measuring chamber.

Possible causes:
- Blockage or leaks

- Difficult aspiration of CAL B due to FMS problems

Remedy:
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace S2 Fluid Pack.
- Check/replace S2 docking mechanism.
  - 👁 For instructions, see *Replacing the docking mechanisms S2 and S3 (fluid packs)* on page B-70.
- Replace the FMS unit.
  - 👁 For instructions, see *Replacing the FMS* on page B-33.
- Replace the FMS control board.
  - 👁 For instructions, see *Replacing the FMS control board* on page B-35.

Flag no. 1002 "Sample sep. error (1)"

No air packet was detected between calibration solution and sample.

Possible causes:
- Deposits or blockage in the measuring chamber

Remedy:
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Test/replace V4.
  - 👁 For instructions, see *Replacing the air valve V4* on page B-88.
- Check/replace air tube at V4.

Flag no. 1003 "Ref. sol. asp. error"

No reference solution was detected.

Possible causes:
- Blockage or leaks in the reference system

Remedy:
- Call up "Fill reference electrode" for the relevant module. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Replace S2/S3 fluid pack.
- Check plug connector of the reference tube.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace reference electrode.

Flag no. 1004 "Ref. sol. pos. error"

The conductivity level could not be maintained.

Possible causes:
- Separation of electrode membrane
- Leaky electrodes

Remedy:
- Call up "Fill reference electrode" for the relevant module.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Replace S2/S3 fluid pack.
- Check plug connector of the reference tube.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace reference electrode.

Flag no. 1005 "End of sample detected"

SS1 detects the end of the sample, but the measuring chamber is not yet filled.

Possible causes:
- Irregular sample
- Insufficient sample
- Improper sample

Remedy:
- Repeat measurement/calibration, ensure sufficient and homogenous sample input.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Test/replace V4.
  👁 For instructions, see *Replacing the air valve V4* on page B-88.
- Check/replace air tube at V4.

Flag no. 1006 "Irregular sample (1)"

The measuring chamber is not homogeneously filled.

Possible causes:
- Irregular sample
- Leakage in measuring channel

Remedy:
- Repeat measurement/calibration, ensure sufficient and homogenous sample input.
- If discoloration can be detected by sample material in the internal electrolyte of the electrode, it must be replaced.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Call up "Contact path test" and aspirate CAL B.
  👁 For the details, see *Contact path test* on page D-95.
- Insert electrode simulator in the relevant module and act accordingly.

Flag no. 1007 "Cuvette not empty"

Sample detection in the cuvette was not possible.

Possible causes:
- Deposits in the cuvette

- Light level too low
- Pump delivery volume too high

Remedy:
- Call up internal cleaning of the COOX module.
  ☞ [System] > [Wash & clean] > [Cleaning modules] > [COOX] > [Start internal cleaning].
- Call up polychromator calibration.
  ☞ [System] > [Calibration] > [Polychr calibration] > [Start].
- Print the service report and check the "SS3-Hemo Pos. Time".
  👁 For the details, see *Service report* on page D-132
- Replace main pump tube.
  👁 For the details, see *Replacing the pump tube* on page B-67.

Flag no. 1008 "Irregular sample (2)"

The conductivity changed after closing the valve at the measuring chamber input.

Possible causes:
- Insufficient wetting in measuring channel
- Separation of electrode membrane
- Leakage in electrode

Remedy:
- Perform "Calibration for Ready".
  ☞ [System] > [Calibrations] > [Calibration for Ready].
- Perform a wetting routine for the relevant module.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Check electrodes for leakage and if necessary replace.
- Check sample distributor-measuring chamber connection for leakage.
  👁 For instructions, see *Sample distributor (SD)* on page B-35.
- Test/replace measuring chamber inlet valve.
  👁 For instructions, see *Replacing the valves from sample distributor cartridge and Hb cartridge* on page B-83.

Flag no. 1009 "Sample pos. error (3)"

The measuring signal was not constant or the measuring channel was not filled homogeneously.

Possible causes:
- Blockage or leakage
- Leaky electrodes
- Sample is fragmented
- Sample is unhomogenous
- Separation of the electrode membrane

Remedy: If discoloration can be detected by sample material in the internal electrolyte of the electrode, it must be replaced.

- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].

- Call up "Contact path test" and aspirate CAL B.
  For the details, see *Contact path test* on page D-95.
- Insert electrode simulator in the relevant module and act accordingly.

Flag no. 1010 "Sample pos. error (4)"

The conductivity was too high.

Possible causes:
- Standby solution aspiration problems
- MSS output pump tube is defective

Remedy:
- Replace MSS output pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up fill routines "Aspirate standby solution" and "Fill ref. electrode MSS" (reference electrode only for instruments with urea installed).
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up "Contact path test" and aspirate standby solution.
  For the details, see *Contact path test* on page D-95.
- Replace S3 Fluid Pack A.

Flag no. 1011 "Sample pos. error (5)"

No constant conductivity was detected at the sensor input.

Possible causes:
- Blockage or leakage
- MSS output pump tube is defective

Remedy:
- Replace MSS output pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up fill routines "Aspirate standby solution" and "Fill ref. electrode MSS" (reference electrode only for instruments with urea installed).
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for Ready".
  ☞ [System] > [Calibrations] > [Calibration for Ready].
- Perform "MSS polarization".
- Perform a wetting routine for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Call up "Contact path test" for MSS and aspirate standby solution.
  For the details, see *Contact path test* on page D-95.
- Insert electrode simulator in the relevant module and act accordingly.
- Replace MSS cassette.

Flag no. 1012 "Sample pos. error (6)"

Conductivity at sensor input was too low.

Possible causes:
- Blockage
- MSS output pump tube is defective
- No fluid in the measuring chamber

Remedy:
- Replace MSS output pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up fill routines "Aspirate standby solution" and "Fill ref. electrode MSS" (reference electrode only for instruments with urea installed).
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for Ready".
  ☞ [System] > [Calibrations] > [Calibration for Ready].
- Run "MSS polarization".
- Perform a wetting routine for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace MSS cassette.

Flag no. 1013 "Sample sep. error (2)"

No air packet was detected between calibration solution and sample. The sample was not aspirated or aspirated too late.

Possible causes:
- Deposits or blockage in measuring path
- MSS output pump tube is defective

Remedy:
- Replace MSS output pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up fill routines "Aspirate standby solution" and "Fill ref. electrode MSS" (reference electrode only for instruments with urea installed).
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Run "MSS polarization".
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace MSS cassette.

Flag no. 1014 "Sample pos. error (7)"

Conductivity at BSA sensor inside MSS cassette is too low.

Possible causes:
- Unhomogenous sample/calibration solution
- Insufficient sample/calibration solution detected
- Measuring path insufficiently wetted

Remedy:
- Ensure that sample input is sufficient and homogenous.
- Perform "MSS polarization".
- Perform a wetting routine for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].

Flag no. 1015 "Sample pos. error (8)"

Conductivity at Lac sensor inside MSS cassette is too low.

Possible causes:
- Unhomogenous sample/calibration solution
- Insufficient sample/calibration solution detected
- Measuring path insufficiently wetted

Remedy:
- Ensure that sample input is sufficient and homogenous.
- Perform "MSS polarization".
- Perform a wetting routine for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].

Flag no. 1016 "Sample pos. error (9)"

Conductivity at Glu sensor inside MSS cassette is too low.

Possible causes:
- Unhomogenous sample/calibration solution
- Insufficient sample/calibration solution detected
- Measuring path insufficiently wetted

Remedy:
- Ensure that sample input is sufficient and homogenous.
- Perform "MSS polarization".
- Perform a wetting routine for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].

Flag no. 1017 "Sample pos. error (10)"

Conductivity at MSS sensor input was too low after positioning the sample/ calibration solution in the measuring chamber.

Possible causes:
- Unhomogenous sample/calibration solution
- Insufficient sample/calibration solution detected
- Measuring path insufficiently wetted

Remedy:
- Ensure that sample input is sufficient and homogenous.
- Perform "MSS polarization".
- Perform a wetting routine for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].

Flag no. 1020 "Sample distr. error (1)"

No solution was detected at SS1 during positioning.

Possible causes:
- Blockage or leakage during positioning

Remedy:
- Call up "Wash".
- Check that bypass nipple is correctly seated.
  For the details, see *Replacing the bypass nipple* on page B-24.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform sample sensor test (SS1). Press [Measure] and [Calibrate].
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test".*
- Replace the SD cartridge.
  For instructions, see *Replacing the sample distributor cartridge* on page B-35.
- Replace sample sensor board
  For instructions, see *Replacing the sample sensor board* on page B-91.

Flag no. 1021 "Sample distr. error (2)"

No solution detected at SS3 although SS2 detected a solution.

Possible causes:
- Blockage or leakage

Remedy:
- Call up "Wash".
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform sample sensor test (SS3). Press [Measure] and [Calibrate].
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test".*
- Replace the Hb cartridge.
  For instructions, see *Replacing the Hb cartridge* on page B-63.
- Replace cuvette.
  For instructions, see *Replacing the cuvette* on page B-59.

Flag no. 1022 "Sample distr. error (3)"

Sample excess could not be extracted via sample distributor.

Possible causes:
- Blockage

Remedy:
- Call up "Wash".
- Check that bypass nipple is correctly seated.
  For the details, see *Replacing the bypass nipple* on page B-24.

- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform sample sensor test (SS2). Press [Measure] and [Calibrate]. ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  - 👁 For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test"*.
- Replace sample sensor board.
  - 👁 For instructions, see *Replacing the sample sensor board* on page B-91.

Flag no. 1023 "Sample distr. error (4)"

No solution was detected at SS4.

Possible causes:
- Blockage or leakage
- Insufficient sample

Remedy:
- Ensure that there is sufficient sample.
- Call up "Wash".
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform sample sensor test (SS4). Press [Measure] and [Calibrate]. ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  - 👁 For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test"*.
- Replace the SD cartridge.
  - 👁 For instructions, see *Replacing the sample distributor cartridge* on page B-35.

Flag no. 1025 "No sample detected (2)"

ISE: No constant conductivity of the sample was detected.

Possible causes:
- Fragmented sample in sample distributor

Remedy:
- Ensure sample entry is free of air bubbles.

Flag no. 1026 "No sample detected (3)"

ISE: No constant conductivity of the sample was detected.

Possible causes:
- Fragmented sample in sample distributor

Remedy:
- Ensure sample entry is free of air bubbles.

Flag no. 1027 "No sample detected (4)"

No sample detected in COOX module.

Possible causes:
- Sample path leaks or is blocked
- Cuvette fill leaks
- Main pump tube defective

Remedy:
- Call up "Wash".
- Check/replace main pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].

Flag no. 1028 "Insufficient sample (1)"

No sample detected in Hb module (tHb/SO_2 or COOX module depending on instrument configuration).

Possible causes:
- Unhomogenous sample
- Insufficient sample

Remedy:
- Ensure that sample input is sufficient and homogenous.

Flag no. 1029 "Insufficient sample (2)"

Insufficient sample for BG module was detected.

Possible causes:
- Unhomogenous sample
- Insufficient sample

Remedy:
- Ensure that sample input is sufficient and homogenous.

Flag no. 1030 "Insufficient sample (3)"

Insufficient sample for ISE module was detected:

Possible causes:
- Unhomogenous sample
- Insufficient sample

Remedy:
- Ensure that sample input is sufficient and homogenous.

Flag no. 1031 "Insufficient sample (4)"

Insufficient sample for MSS module was detected.

Possible causes:
- Unhomogenous sample
- Insufficient sample

Remedy:
- Ensure that sample input is sufficient and homogenous.

- With uncalibrated sensor call up fill routines for CAL 2, CAL 3 and CAL 4.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL #].

Flag no. 1032 "Sample distr. error (5)"

No calibration solution 1 (CAL 1) detected.

Possible causes:
- Blockage or leakage
- Main pump tube defective

Remedy:
- Call up fill routine for CAL 1.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL 1].
- Check/replace main pump tube.
  👁 For the details, see *Replacing the pump tube* on page B-67.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Check/replace S3 docking mechanism.
  👁 For instructions, see *Replacing the docking mechanisms S2 and S3 (fluid packs)* on page B-70.
- Call up "Component test > Control sensors > Sample sensors" and "Calibrate" (SS4).
  👁 For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test"*.

Flag no. 1036 "Insufficient sample (5)"

Insufficient sample for MSS module was detected.

Possible causes:
- Unhomogenous sample
- Insufficient sample

Remedy:
- Ensure that sample input is sufficient and homogenous.
- Call up fill routines for CAL 2, CAL 3 and CAL 4.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate CAL #].
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Check/replace S3 docking mechanism.
  👁 For instructions, see *Replacing the docking mechanisms S2 and S3 (fluid packs)* on page B-70.
- Perform sample sensor test (SS4). Press [Measure] and [Calibrate].
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  👁 For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test"*.

Flag no. 1037 "No sample detected (8)"

No sample detected in hemolyzer.

Possible causes:
- Aspiration path leaks or is blocked

Remedy:
- Call up "Hemolyzer test".
  For instructions, see *Hemolyzer* on page D-131.
- Check/replace main pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Check COOX module cuvette for leaks and if necessary replace.
  For the details, see *Replacing the cuvette* on page B-59.

Flag no. 1038 "No sample detected (9)"

No rinse solution detected by SS3 during calibration of Hb module (tHb/SO_2 or COOX module depending on instrument configuration).

Possible causes:
- Aspiration path leaks or is blocked

Remedy:
- Call up "Wash".
- Check/replace main pump tube.
  For the details, see *Replacing the pump tube* on page B-67.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Check COOX module cuvette for leaks and if necessary replace.
  For the details, see *Replacing the cuvette* on page B-59.
- Perform sample sensor test (SS3). Press [Measure] and [Calibrate]. ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test".*

Flag no. 1050 "No sample in SIP"

No sample detected in the sample inlet path at SS2 or SS6.

Possible causes:
- Sample path leaks or is blocked
- No sample was input

Remedy:
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Check seating of T&D lock.
  For the details, see *T&D system (Turn & Dock)* on page B-21.
- Check that bypass nipple is correctly seated.
  For the details, see *Replacing the bypass nipple* on page B-24.
- Prevent direct sunlight or fluorescent light on the plug control (incorrect sample container detection).

- Perform sample sensor test (SS2 and SS6). Press [Measure] and [Calibrate].
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  👁 For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test"*.

Flag no. 1051 "No AQC sample detected "

No sample was recognized at SS5.

Possible causes:
- Sample path leaks or is blocked
- Incorrect AutoQC material assignment

Remedy:
- Call up "Wash AutoQC".
- Check AutoQC material assignment (incorrect assignment of ampoules).
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, section "Material assignment – AutoQC materials"*.
- Check/replace AutoQC steel tube.
  👁 For instructions, see *Replacing the AutoQC steel tube* on page B-133.
- Perform sample sensor test (SS5). Press [Measure] and [Calibrate].
  ☞ [System] > [Component test] > [Control sensors] > [Sample sensors].
  👁 For instructions, refer to the **cobas b** 221 system *Reference Manual, section "Component test"*.

Flag no. 1052 "No vacuum"

No regulated low pressure could be build up during aspiration process.

Possible causes:
- Defective vacuum system
- Incorrect Baro setup

Remedy:
- Check Baro settings.
  👁 For instructions, see *Baro sensor* on page D-101, *Baro settings* on page B-5.
- Perform vacuum system test.
  👁 For the details, see *Vacuum System* on page D-101.

Flag no. 2004 "Repro. not ok"

Sensor signal cannot be reproduced.

Possible causes:
- Invalid sample type used
- Measuring path contaminated
- Bubbles in internal electrolyte of the electrodes on the membrane
- Interference signals in the measuring path during measurement value acquisition
- Interference signals over the reference electrodes during measurement value acquisition
- Loss of sensitivity of an electrode

Remedy:

- Perform "Calibration for Ready".
  ☞ [System] > [Calibrations] > [Calibration for Ready].
- Perform a wetting routine for the relevant module.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Remove the electrode and tap the body of the electrode with a finger nail to detach any air bubbles from the electrode membrane.
- Call up the stability monitor and check "Details" of the "Electrode slope". If the electrode/cartridge is defective, it is displayed. Replace the corresponding electrode or cartridge.
  👁 For the details, see *Stability monitor* on page D-120.
- If the sample path is visibly contaminated, perform "Internal cleaning" for the module (caution: MSS excepted).
  ☞ [System] > [Wash & cleaning] > [Cleaning modules].

Do not perform MSS cleaning!

When performing an internal or an external cleaning of the MSS module, the MSS cartridge will be damaged!

- If the error affects potentiometric electrodes/sensors (pH, urea, all ISE electrodes), the reference electrode of the module must be replaced.

Flag no. 2009 "Recal. not OK"

Signal difference occurring during recalibration of PCO_2 was too large.

Possible causes:

- Invalid sample type used

Remedy:

- Perform "Calibration for Ready".
- Call up the stability monitor and check "Details" of the "Electrode slope". If the PCO_2 electrode is defective, it is displayed. Replace the PCO_2 electrode.
  👁 For the details, see *Stability monitor* on page D-120.

Flag no. 2011 "Sensor signal instable"

Sensor signal cannot be reproduced.

Possible causes:

- Invalid sample type used
- S1 Rinse Solution contaminated
- Bubbles in internal electrolyte of the electrodes on the membrane
- Interference signals in the measuring path during measurement value acquisition
- Interference signals over the reference electrodes during measurement value acquisition

Remedy:

- Check seating of top cover.
- Perform "Calibration for Ready".
- If this interference concerns the entire module, the reference electrode of the module must be replaced.

- Remove the electrode and tap the body of the electrode with a finger nail to detach any air bubbles from the electrode membrane.
- Call up the stability monitor and check "Details" of the "Electrode slope". If the electrode/cartridge is defective, it is displayed. Replace the corresponding electrode or cartridge.
  👁 For the details, see *Stability monitor* on page D-120.
- Check ground cable plug connector on bottle compartment cover.
- Check seating of the pump gasket of the MSS output pump.
  👁 For the details, see *Peristaltic pumps (PP)* on page B-64.
- Insert electrode simulator and act accordingly.
- Replace affected measuring chamber.
  👁 For the details, see *BG measuring chamber* on page B-40, *ISE measuring chamber (cobas b 221<3>–<6> systems only)* on page B-42 and *MSS measuring chamber (cobas b 221<5/6> systems only)* on page B-44.

Flag no. 2012 "Sensor signal is drifting"

The sensor signal is drifting.

Possible causes:

- Invalid sample type used
- S1 Rinse Solution contaminated
- Aspiration of S1 Rinse Solution not ok
- Bubbles in internal electrolyte of the electrodes on the membrane
- Interference signals in the measuring path during measurement value acquisition

Remedy:

- Perform "Calibration for Ready".
- Remove the electrode and tap the body of the electrode with a finger nail to detach any air bubbles from the electrode membrane.
- Call up the stability monitor and check "Details" of the "Electrode slope". If the electrode/cartridge is defective, it is displayed. Replace the corresponding electrode or cartridge.
  👁 For the details, see *Stability monitor* on page D-120.
- Call up fill routine "Aspirate rinse".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate rinse].
- Replace S1 Rinse Solution.
- Replace measuring chamber cartridge.
  👁 For instructions, see *Replacing the measuring chamber cartridge* on page B-48.
- Insert electrode simulator and act accordingly.
- Test/replace V4.
  👁 For instructions, see *Replacing the air valve V4* on page B-88.
- Check/replace air tube at V4.

Flag no. 2016 "Signal too high"

The 1st sampling value of the O_2 zero point calibration is >60 mV.

Possible causes:
- An air bubble has falsified the calibration
- Defective electrode
- Unhomogenous O_2 zero point solution

Remedy:
- Perform "Calibration for Ready".
- Call up "Wetting routine" for BG.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up fill routine "Aspirate solution O2 zero". ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate solution O2 zero].
- Replace S2 Fluid Pack.
- Replace PO_2 electrode.
- Insert electrode simulator and act accordingly.

Flag no. 2021 "Drift alarm"

A drifting of the sensor signal was detected in the "Ready" state.

Possible causes:
- The electrode drifts exceed the default limit values
- Invalid sample type used
- Wetting problems
- PO_2 contamination

Remedy:
- Perform "Calibration for Ready".
- Call up "Wetting routine" for BG.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up the stability monitor and check "Details" of the "Electrode slope". If the electrode/cartridge is defective, it is displayed. Replace the corresponding electrode or cartridge.

  👁 For the details, see *Stability monitor* on page D-120.
- If the flag refers to the PO_2 electrode, call up "Aspirate MIX 1" in the meas. sensors test for BG.

  👁 For the details, see *Meas. sensors* on page D-103.

  The standard deviation of the PO_2 sensor signal must be no greater than 50 mV within two minutes.
  - If the standard deviation was too high, perform "Internal cleaning" for BG.
    ☞ [System] > [Wash & cleaning] > [Cleaning modules]
  - In case the error was resolved, set the interval for "BG cleaning" to 3 days.
    ☞ [Setup] > [Times & intervals] > [Maintenance timing]
    Perform an "External cleaning" for BG with Deproteinizer if necessary.
- Insert electrode simulator and act accordingly.

Flag no. 2022 "Ref. drift alarm"

A drifting of the sensor signal was detected at the reference electrode in the "Ready" state.

Possible causes:
- Bubbles interfere with reference system

- S2 Fluid Pack docking mechanism contaminated

Remedy:
- Call up "Fill reference electrode" for the relevant module. ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for ready".
- Check S2 docking mechanism for contamination and if necessary clean it.
- Replace reference electrode.
- Call up "General fluidics test" and check that tubing paths are open and without leaks, particularly the seals of the reference valves. ☞ [System] > [Diagnostics] > [General fluidics test].
- Insert electrode simulator and act accordingly.

Flag no. 2023 "1 point sensitivity drifts"

The 1 point sensitivity of the MSS sensor drifts.

Possible causes:
- The sensor has not completed the startup phase and the 1-point sensitivity is still strongly increasing.

Remedy:
- Perform "Calibration for Ready".

Flag no. 2024 "Air bubble detected"

Before washing out the sample the conductivity value was not detected as pressure-stable.

Possible causes:
- A blood gas electrode has not filled bubble-free
- Leaky VBI
- Leaky sample path in BG

Remedy:
- Call up "General fluidics test" and check that tubing paths are open and without leaks, particularly the range VBI and BG measuring chamber. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace PO_2 electrode.
- Replace PCO_2 electrode.

Flag no. 2028 "Mean not OK"

Measurement value of calibration is outside the expected range.

Possible causes:
- Defective electrode
- Incorrect Baro value

Remedy:
- Call up a "System Calibration" for the relevant module.
- If only one electrode is affected, replace that electrode.
- If more than one electrode/sensor is affected, replace S2 or S3 fluid pack depending on the module.

- Check Baro settings.
  For instructions, see *Baro sensor* on page D-101, *Baro settings* on page B-5.
- Insert electrode simulator and act accordingly.

Flag no. 2029 "ADC >>>>>"

Sensor signal is above the measuring range.

Possible causes:
- Reference system not filled
- Leaky/empty electrode

Remedy:
- Call up "Fill reference electrode" for the relevant module.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for ready".
- Check electrode seating.
- Replace relevant electrode/cartridge.
- Insert electrode simulator and act accordingly.

Flag no. 2030 "ADC <<<<<"

Sensor signal is below the measuring range.

Possible causes:
- Reference system not filled
- Leaky/empty electrode

Remedy:
- Call up "Fill reference electrode" for the relevant module.
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for ready".
- Check electrode seating.
- Replace relevant electrode/cartridge.
- Insert electrode simulator and act accordingly.

Flag no. 2031 "Conditioning not ok"

The Na electrode was not conditioned.

Possible causes:
- S2 docking mechanism leaky
- T&D leaky when aspirating conditioner

Remedy:
- Call up "Aspirate Na cond solution".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up "Conditioning".
  ☞ [System] > [Utilities] > [Fluid actions] > [Conditioning].
- Replace S2 Fluid Pack.
- Check S2 docking mechanism for contamination and if necessary clean it.

- Call up "General fluidics test" and check that tubing paths are open and without leaks, particularly the range VBI and BG measuring chamber.
  ☞ [System] > [Diagnostics] > [General fluidics test].
  👁 For details, see diagrams in Chapter 2 *Fluid actions*.

Flag no. 2035 "Linearity not OK"

The sensitivity of the MSS sensor is too low.

Possible causes:
- Sensor worn out

Remedy:
- New installed MSS cartridge:
  - After a polarization check the MSS linearity (Glu, Lac, Urea) using the sensor report and perform a 2P calibration.
    👁 For the details, see *Sensor limits (Sensor report)* on page D-135.
- Replace MSS cassette.
- Replace S3 Fluid Pack A.

Flag no. 2036 "Interference sensitivity"

The sensitivity of the MSS sensor is too low.

Possible causes:
- Sensor worn out

Remedy:
- New installed MSS cartridge:
  - After a polarization check the MSS linearity (Glu, Lac, Urea) using the sensor report and perform a 2P calibration.
    👁 For the details, see *Sensor limits (Sensor report)* on page D-135.
- Replace MSS cassette.
- Replace S3 Fluid Pack A.

Flag no. 2040 "Cuvette not OK"

Calibrated layer thickness of the cuvette is outside the expected range.

Possible causes:
- Contamination of the cuvette

Remedy:
- Replace cuvette.
  👁 For the details, see *Replacing the cuvette* on page B-59.
- Call up "Polychromator calibration".
- Call up "COOX calibration".

Flag no. 2041 "Ref. point not OK"

Reference point is outside the expected range.

Possible causes:
- Sample feeding clogged

Remedy:
- Call up "Wash".
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace cuvette.
  👁 For the details, see *Replacing the cuvette* on page B-59.
- Call up "Polychromator calibration".
- Call up "COOX calibration".

Flag no. 2042 "Wavelength not OK"

Polychromator wavelength not ok.

Possible causes: A specific wavelength is outside the expected range.

Remedy:
- Call up "Polychromator calibration".
- Replace polychromator.
  👁 For instructions, see *Replacing the Polychromator Bilirubin* on page B-54.
- Replace lamp unit bilirubin.
  👁 For instructions, see *Replacing the lamp unit bilirubin* on page B-51.

Flag no. 2043 "Hemolysis not OK (1)"

Hemolysis was not ok.

Possible causes: The hemolyzer is not ready for operation.

Remedy:
- Visually inspect that hemolyzer tubing is dry.
- Perform vacuum system test.
  👁 For the details, see *Vacuum System* on page D-101.
- Call up hemolyzer test and depending on the result replace hemolyzer unit or HSIN board.
  👁 For instructions, see *Replacing the hemolyzer* on page B-60.

Flag no. 2044 "Hemolysis not OK (2)"

Hemolysis was not ok.

Possible causes: The hemolyzer power is outside the expected range.

Remedy:
- Visually inspect that hemolyzer tubing is dry.
- Perform vacuum system test.
  👁 For the details, see *Vacuum System* on page D-101.
- Call up hemolyzer test and depending on the result replace hemolyzer unit or HSIN board.
  👁 For instructions, see *Replacing the hemolyzer* on page B-60.

Flag no. 2070 "Sensor signal unstable"

Sampling criterion for tHb measurement value calculation violated.

Possible causes:
- Irregular sample
- Sample feed leaks or is blocked

Remedy:
- Perform "Internal cleaning" for the tHb/SO_2 module.
  ☞ [System] > [Wash & cleaning] > [Cleaning modules].
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Perform vacuum system test.
  👁 For the details, see *Vacuum System* on page D-101.
- Replace S1 Rinse Solution.

Flag no. 2071 "Measuring path dirty"

The absolute limits of water calibration are outside the specified range.

Possible causes:
- Sensor dirty

Remedy:
- Perform "Internal cleaning" for the tHb/SO_2 module.
  ☞ [System] > [Wash & cleaning] > [Cleaning modules].
- Replace S1 Rinse Solution.
- Replace tHb/SO_2 module.
  👁 For the details, see *Replacing the tHb/SO_2 module* on page B-62.

Flag no. 3000 "D2/D3 not performed"

MSS standby solution was not aspirated.

Possible causes:
- Aspiration of MSS standby solution not ok

Remedy:
- Call up "Aspirate standby solution".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up "Fill ref. electrode MSS".
- Perform "Calibration for ready".

Flag no. 3001 "FMS volume error"

The calibration solution is not aspirated into the BG measuring chamber in the specified time.

This flag corresponds to the *Error 20016 "FMS volume error"* module stop.

Possible causes and remedy:
👁 For instructions, see *Error 20016 "FMS volume error"* on page D-38.

Flag no. 3002 "Temperature error"

The module temperature is outside the permitted range.

This flag corresponds to the temperature module stop for the relevant module.

Possible causes and remedy:

For instructions, see:
Error 20000 "SD temp. nOk" on page D-37
Errors 20032...20034 "BG temperature nOk" on page D-40
Error 20035 "BG temperature nOk" on page D-41
Errors 20048...20050 "ISE temperature nOk" on page D-42
Error 20051 "ISE temperature nOk" on page D-42
Error 20072 "COOX temperature nOk" on page D-44
Errors 20087...20089 "MSS temperature nOk" on page D-46
Error 20096 "tHb/SO_2 temperature nOk" on page D-48
Error 20142 "AQC temperature nOk" on page D-51

Flag no. 3003 "FMS error"

The mixture ratio falls outside the specified range.

This flag corresponds to the *Error 20017 "FMS error"* module stop.

Possible causes and remedy:

For instructions, see *Error 20017 "FMS error"* on page D-38.

Flag no. 3004 "AQC module error"

The required position was not reached.

This flag corresponds to the AQC module stops.

Possible causes and remedy:

For instructions, see:
Error 20113 "module error AQC" on page D-49
Error 20114 "module error AQC" on page D-49
Errors 20115...20118 "module error AQC" on page D-50

Flag no. 3013 "Ref. point D1 not ok"

Problem during precalibration.

Possible causes:

- Aspiration of MSS standby solution not ok

Remedy:

For details, see *Aspirating MSS reference solution, calibration with standby solution* on page A-39.

- Call up "Aspirate standby solution".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up "Fill ref. electrode MSS"
  (reference electrode only for instruments with urea installed).
- Perform "Calibration for ready".

- Call up "Wetting routine" for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up "Contact path test" for MSS and aspirate standby solution.
  👁 For the details, see *Contact path test* on page D-95.
- Replace MSS cassette.

Flag no. 3014 "Ref. point not ok"

Problem with calibration with MSS standby solution.

Possible causes:
- Aspiration of MSS standby solution not ok

Remedy:
👁 For details, see *Aspirating MSS reference solution, calibration with standby solution* on page A-39.
- Call up "Aspirate standby solution".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up "Fill ref. electrode MSS"
  (reference electrode only for instruments with urea installed).
- Perform "Calibration for ready".
- Call up "Wetting routine" for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up "Contact path test" for MSS and aspirate standby solution.
  👁 For the details, see *Contact path test* on page D-95.
- Replace MSS cassette.

Flag no. 3015 "1P not OK"

Problem at 1P calibration point.

Possible causes:
- Second calibration point is not calibrated since an error occurred at the first calibration point.

Remedy:
- Perform "Calibration for Ready".

Flag no. 3022 "Conductivity not OK"

The conductivity is not ok.

Possible causes: Conductivity calibration was not ended properly

Remedy:
- Print the sensor report and check the status for conductivity BG for CAL B (B Pot) and CAL A (A Pot).
  ☞ > [Miscellaneous reports] > [Sensor report].
  👁 For the details, see *Sensor limits (Sensor report)* on page D-135.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace S2 Fluid Pack.

Flag no. 3033 "0P not OK"

O_2 zero calibration was not ended properly.

Possible causes:
- Aspiration of O_2 zero point solution not ok
- Soiling or leaky point

Remedy:
- Call up fill routine "Aspirate solution O2 zero". ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines] > [Aspirate solution O2 zero].
- Check T&D disk and input unit for soiling.
  👁 For instructions, refer to the **cobas b** 221 system *Instructions for Use, Chapter "Maintenance"*.
- Call up "General fluidics test" and check that tubing paths are open and without leaks. ☞ [System] > [Diagnostics] > [General fluidics test].
- Replace S2 Fluid Pack.

Flag no. 4003 "Calibration pending (1)"

A calibration is pending.

Possible causes:
- New sensor was inserted, no calibration values present

Remedy:
- Perform "Calibration for Ready".

Flag no. 4008 "Calibration pending (2)"

A calibration is pending.

Possible causes:
- Calibration is missing or was canceled

Remedy:
- Perform "Calibration for Ready".

Flag no. 4024 "Calibration pending (3)"

A calibration is pending.

Possible causes:
- Sensor is or was deactivated

Remedy:
- Perform "Calibration for Ready".

Flag no. 5006 "Calculation error (1)"

Microcontroller calculation error.

Possible causes:
- An illegal calculation operation has occurred

Remedy:
- Remove and replace all solutions and packs (W, S1, S2, S3).

- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check Baro settings.
  For instructions, see *Baro sensor* on page D-101, *Baro settings* on page B-5.
- Reinstall software.
  For the details, see *Software update* on page B-104.

Flag no. 5007 "Calculation error (2)"

Microcontroller calculation error.

Possible causes:
- An illegal calculation operation has occurred

Remedy:
- Remove and replace relevant electrode.
- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Reinstall software.
  For the details, see *Software update* on page B-104.

Flags no. 5010...5012 "Calculation error (3...5)"

Microcontroller calculation error at the COOX module.

Possible causes:
- An illegal calculation operation has occurred

Remedy:
- Check cuvette for soiling and replace if necessary.
  For the details, see *Replacing the cuvette* on page B-59.
- Call up "Polychromator calibration".
- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Reinstall software.
  For the details, see *Software update* on page B-104.

Flag no. 6026 "ADC error"

An ADC error occured.

Possible causes: Problem with ADC on amplifier board

Remedy:
- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Check cable press fit of the module connector cable on the mainboard for damage.
  For details, see Figure B-67 on page B-90.
- Replace relevant module.
  For the details, see:
  Replacing the BG measuring chamber on page B-40
  Replacing the ISE measuring chamber on page B-42
  Replacing the MSS measuring chamber on page B-44
  COOX module (cobas b 221<2/4/6> systems only) on page B-51
  Replacing the tHb/SO_2 module on page B-62

- If the conductivity is not OK, replace mainboard.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Flag no. 6030 "COOX HW error"

A hardware error occured at the COOX module.

This flag corresponds to the COOX module stops.

Possible causes and remedy:

👁 For instructions, see:
Error 20068 "COOX HW error" on page D-43
Error 20069 "COOX HW error" on page D-44
Error 20071 "COOX HW error" on page D-44

Flag no. 6031 "Neon lamp not OK"

The light output of the neon lamp is too low.

Possible causes:

- Cuvette contaminated
- Light guide damaged
- Polychromator electronics defective

Remedy:

- Perform "Internal cleaning" for the COOX module.
  ☞ [System] > [Wash & cleaning] > [Cleaning modules].
- Call up "Polychromator calibration".
- Replace cuvette.
  👁 For instructions, see *Replacing the cuvette* on page B-59.
- Check/replace cuvette holder.
  👁 For instructions, see *Replacing the cuvette holder* on page B-58.
- Check primary light guide for damage and if necessary replace it.
  👁 For instructions, see *Replacing the primary light guide* on page B-56.
- Replace lamp unit bilirubin.
  👁 For instructions, see *Replacing the lamp unit bilirubin* on page B-51.
- Replace polychromator bilirubin.
  👁 For instructions, see *Replacing the Polychromator Bilirubin* on page B-54.

Flag no. 6032 "Halogen lamp not OK"

The light output of the halogen lamp is too low.

Possible causes:

- Cuvette contaminated
- Light guide damaged
- Polychromator electronics defective

Remedy:

- Perform "Internal cleaning" for the COOX module.
  ☞ [System] > [Wash & cleaning] > [Cleaning modules].

- Call up "Polychromator calibration".
- Replace cuvette.
  For instructions, see *Replacing the cuvette* on page B-59.
- Check/replace cuvette holder.
  For instructions, see *Replacing the cuvette holder* on page B-58.
- Check primary light guide for damage and if necessary replace it.
  For instructions, see *Replacing the primary light guide* on page B-56.
- Replace lamp unit bilirubin.
  For instructions, see *Replacing the lamp unit bilirubin* on page B-51.
- Replace polychromator bilirubin.
  For instructions, see *Replacing the Polychromator Bilirubin* on page B-54.

Flag no. 7034 "Solution exhausted"

The pH value of the O_2 zero point solution is < 5.

Possible causes:
- Solution used up
- Contamination of S2 Fluid pack

Remedy:
- Replace S2 Fluid Pack.

Flag no. 8036 "IfS not OK"

The ratio of BSA/Glu or BSA/Lac for CAL 3 is out of range.

Possible causes:
- Interference correction not possible

Remedy:
- Perform "Calibration for Ready".
- Replace MSS cassette.
- Replace S3 Fluid Pack A.
- Check tubing for solutions CAL 1 and CAL 3.
  For more information, see Chapter 2 *Fluid actions*.

Flag no. 8061 "Interferences (1)"

The calculated tHb value is invalid.

Possible causes:
- Interferences
- Unsuitable sample type used

Remedy:
- Check the sample material and, if necessary, reenter the sample.
- Perform "Polychromator calibration".
- Replace cuvette.
  For instructions, see *Replacing the cuvette* on page B-59.

- Call up hemolyzer test and depending on the result replace hemolyzer unit or HSIN board.
  👁 For instructions, see *Hemolyzer (cobas b 221<2/4/6> systems only)* on page D-100.

Flag no. 8062 "Interferences (2)"

The calculated Hb derivatives are invalid.

Possible causes:
- Interferences
- Unsuitable sample type used

Remedy:
- Check the sample material and, if necessary, reenter the sample.
- Perform "Polychromator calibration".
- Replace cuvette.
  👁 For instructions, see *Replacing the cuvette* on page B-59.
- Call up hemolyzer test and depending on the result replace hemolyzer unit or HSIN board.
  👁 For instructions, see *Hemolyzer (cobas b 221<2/4/6> systems only)* on page D-100.

Flag no. 8063 "Interferences (3)"

The calculated value of Bilirubin is invalid.

Possible causes:
- Interferences
- Unsuitable sample type used

Remedy:
- Check the sample material and, if necessary, reenter the sample.
- Perform "Polychromator calibration".
- Replace cuvette.
  👁 For instructions, see *Replacing the cuvette* on page B-59.
- Call up hemolyzer test and depending on the result replace hemolyzer unit or HSIN board.
  👁 For instructions, see *Hemolyzer (cobas b 221<2/4/6> systems only)* on page D-100.

Flag no. 8070 "IfS repro. not OK"

Non-reproducible sensor signal at interference sensor.

Possible causes:
- Unsuitable sample type used

Remedy:
- Call up "Wetting routine" for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Perform "MSS polarization".

- Perform "Calibration for Ready".
- Replace MSS cassette.

Flag no. 8071 "IfS calculation error (1)"

Microcontroller calculation error on interference sensor.

Possible causes:
- An illegal calculation operation has occurred

Remedy:
- Remove and replace MSS cassette.
- Remove and replace S3 Fluid Pack A.
- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Reinstall software.
  For the details, see *Software update* on page B-104.

Flag no. 8072 "IfS calculation error (2)"

Microcontroller calculation error on interference sensor.

Possible causes:
- An illegal calculation operation has occurred

Remedy:
- Remove and replace MSS cassette.
- Remove and replace S3 Fluid Pack A.
- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Reinstall software.
  For the details, see *Software update* on page B-104.

Flag no. 8073 "IfS sensor signal unstable"

Interference sensor signal cannot be reproduced.

Possible causes:
- Unsuitable sample type used
- Measuring path contaminated
- Interference signals in the measuring path during measurement value acquisition
- Interference signals over the reference electrodes during measurement value acquisition

Remedy:
- If this interference applies to the complete MSS module, the reference electrode must be changed (reference electrode only for instruments with urea installed).
- Perform "Calibration for Ready".
- Call up the stability monitor and check "Details" of the "Electrode slope". If the MSS cassette is defective, it is displayed. Replace the MSS cassette.
  For the details, see *Stability monitor* on page D-120.
- Insert electrode simulator and act accordingly.

Flag no. 8074 "IfS ref. point not ok"

Problem at reference point of MSS standby solution at interference sensor.

Possible causes:
- Aspiration of MSS standby solution not ok
- Aspiration of MSS reference solution not ok

Remedy:
- Call up "Aspirate standby solution".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Call up "Fill ref. electrode MSS".
- Perform "Calibration for ready".
- Call up "Wetting routine" for MSS.
  ☞ [System] > [Utilities] > [Fluid actions] > [Wetting routines].
- Call up "Contact path test" for MSS and aspirate standby solution.
  👁 For the details, see *Contact path test* on page D-95.
- Replace MSS cassette.

Flag no. 8075 "IfS ADC error"

Interference sensor ADC error.

Possible causes: Problem with ADC of an interference sensor on the amplifier board.

Remedy:
- Replace MSS module.
- If the conductivity is not OK, replace mainboard.
  👁 For instructions, see *Replacing the Mainboard unit* on page B-89.

Flag no. 8076 "IfS mean not OK"

Final calibration value of an interference sensor (IfS) is out of range.

Possible causes:
- Transponder error on S3 Fluid Pack A
- Defective electrode
- Incorrect Baro value

Remedy:
- Call up "System Calibration" for MSS.
- Replace MSS cassette.
- Replace S3 Fluid Pack A.
- Check Baro settings.
  👁 For instructions, see *Baro sensor* on page D-101, *Baro settings* on page B-5.
- Insert electrode simulator and act accordingly.

Flag no. 8077 "IfS ADC >>>>>"

Interference sensor signal is above/below ADC range.

Possible causes:
- Reference system not filled
  (reference electrode only for instruments with urea installed)
- Leaky/empty electrode

Remedy:
- Call up "Fill ref. electrode MSS".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for ready".
- Check electrode seating.
- Replace MSS cassette.
- Insert electrode simulator and act accordingly.

Flag no. 8078 "IfS ADC <<<<<"

Interference sensor signal is below ADC range.

Possible causes:
- Reference system not filled
  (reference electrode only for instruments with urea installed)
- Leaky/empty electrode

Remedy:
- Call up "Fill ref. electrode MSS".
  ☞ [System] > [Utilities] > [Fluid actions] > [Fill routines].
- Perform "Calibration for ready".
- Check electrode seating.
- Replace MSS cassette.
- Insert electrode simulator and act accordingly.

Flag no. 8080 "Interferences (4)"

Detected sample type is invalid.

Possible causes:
- Unsuitable sample type
- For Bilirubin: tHb value is less than 3 g/dL

Remedy:
- Check sample material: sample too old, partially hemolyzed, unhomogenous, incorrect anticoagulant.

Flag no. 8081 "Interferences (5)"

The calculated COHb value is outside the permitted range.

Possible causes:
- Unsuitable sample type

Remedy:
- Check sample material: sample too old, partially hemolyzed, unhomogenous, incorrect anticoagulant.

Flag no. 8082 "Interferences (6)"

The calculated SO_2 value is outside the permitted range.

Possible causes:
- Unsuitable sample type

Remedy:
- Check sample material: sample too old, partially hemolyzed, unhomogenous, incorrect anticoagulant.

Flag no. 8083 "Sample type conflict"

Detected sample type is invalid.

Possible causes:
- Unsuitable sample type used

Remedy:
- Check sample material.

Flag no. 8084 "Invalid sample type"

All calculated values that are based on measurement values of arterial or capillary blood cannot be displayed.

Possible causes:
- Instead of arterial or capillary blood a different blood type was used

Remedy:
- Use arterial or capillary blood as sample material and set the correct sample type.

Flag no. 9000 "Calculation error (3)"

PC calculation error.

Possible causes:
- An illegal calculation operation has occurred

Remedy:
- Remove and replace solutions and packs.
- Turn the instrument off, wait at least 3 minutes, and turn it back on.
- Reinstall software.

For the details, see *Software update* on page B-104.

Flag no. 9001 "Not activated"

Parameter is not activated for measurement (gray).

Flag no. 9002 "Not calibrated"

Parameter is not calibrated (red cross).

Remedy:
- Perform "Calibration for ready".

Flag no. 9003 "Measurement running"

Will be displayed instead of a measurement result as long as the measurement was not finished.

Flag no. 9004 "Out of range (-)"

Measurement value is outside (below) the normal range.

Flag no. 9005 "Out of range (+)"

Measurement value is outside (above) the normal range.

Flag no. 9006 "tHb not OK"

Indicates at the parameter SO_2, that the tHb value is outside the normal range.

Flag no. 9008 "Missing data"

The calculation of this parameter is not possible because of missing base values.

Flag no. 9009 "Measurement aborted"

The measuremant was aborted by the user.

Flag no. 9010 "System stop occured"

A system stop occured during the measurement.

USB troubleshooting

USB functionality

When USB mass storage devices (USB flash drives) are connected to the instrument export and import will use USB instead of floppy disk. Export to and import from USB mass storage requires software version 5.00 or higher to be installed on instruments using touch screen/PC units version 4.X or higher and interface unit ***cobas b*** *221 system > SN 3000.*

Error exporting data

The export to USB mass storage failed.

Possible causes:
- USB mass storage is full
- USB mass storage was disconnected during export
- USB mass storage is write protected

Remedy:
- Ensure to have enough free space available on the USB mass storage.
- Keep the USB mass storage connected until export is completed.
- Ensure the USB mass storage is not write protected.

Export file name exists on USB medium

When the export file name already exists on the USB mass storage it will be overwritten without warning. Risk of data loss.

Data exported to floppy disk instead of USB

The export to USB mass storage failed, the instrument prompts for a floppy disk.

Possible causes:
- USB mass storage is not connected to the instrument
- Software version 5.00 or higher is not installed
- Touch screen/PC unit version 4.X or higher is not present
- Interface unit **cobas b** 221 system > SN 3000 is not present

Remedy:
- Requirements for USB funtionality have to be fulfilled.

For more information, see *USB functionality* on page D-91.

Touch screen/PC unit troubleshooting

Based on all known error pictures associated with the touch screen/PC unit the troubleshooting list contains the possible root causes and the suggested corrective actions. The corrective actions have to be addressed sequentially in the provided order.

Troubleshooting list

Error picture	Possible cause	Corrective action
PC looses Date and Time after start up.	Defective main board battery.	Replace the battery and control electronic. 👁 For details, see *Replacing the battery and charger* on page B-102.
Floppy disk access does not work.	Damaged floppy disk.	Use new floppy disks.
	Defective floppy disk drive.	Replace the floppy disk drive. 👁 For details, see *Replacing the floppy disk drive* on page B-101.
Damaged touch screen surface or display unit.	Spilled liquid or mechanical force damaged the touch screen or display unit.	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
Flickering of the displayed screen.	Problems with the power supply.	Check general power supply or replace the power supply unit, if the general hardware tests interrupts at beginning. 👁 For details, see *General hardware test* on page D-127 and *Stability monitor*, section *Temperature drift* on page D-125.
	Defective display backlight.	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
PC does not give acoustic signals.	Volume setting.	Check volume setting: ☞ [Settings] > [Instrument] > [Sound].
	Speaker cable damaged.	Check speaker cable. 👁 For details, see Figure B-77 on page B-101.
	Main board defective.	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
Software shows "database not ready".	During start up phase: Database needs to be repaired and/or initialized.	Wait until the database is repaired and initialized.
	During operation: Database is damaged.	The databases should be deleted. ☞ [Data Manager] > [Utilities] > [Protected DB functions] > [Delete All databases]. In case the error persists, replace the hard disk and the hard disk bus cable. 👁 For details, see *Replacing the hard disk* on page B-99.

Table D-1 Touch screen/PC unit trouble shooting list

Error picture	Possible cause	Corrective action
Black screen.	Problems with the connection between PC and interface board.	Check the connection between touch screen/PC unit and interface unit. 👁 For details, see *Interface unit connector cable* on page B-93.
	Problems with the power supply.	Check general power supply or replace the power supply unit, if the general hardware tests interrupts at beginning. 👁 For details, see *General hardware test* on page D-127 and *Stability monitor*, section *Temperature drift* on page D-125.
	Unspecified hardware problem (interface board).	Replace the interface unit. 👁 For details, see *Replacing the Interface unit* on page B-92.
	Unspecified hardware problem (PC main board).	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
	Defective display backlight.	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
Software lock up ending up in a software freeze or in a return to the operating system.	Unspecified software problem.	Switch off the instrument and remove the network cable. Wait at least 3 minutes and turn it back on.
	Defective hard disk bus cable.	Replace the hard disk bus cable. 👁 For details, see *Replacing the hard disk* on page B-99.
	Defective hard disk.	Replace the hard disk and the hard disk bus cable. 👁 For details, see *Replacing the hard disk* on page B-99.
	Touch screen/PC unit main board hardware problem.	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
	Touch screen is damaged (only for "freeze").	Replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95.
PC does not boot showing "Calibrating delay loop error".	Bios problem. (See also error picture E in Product Bulletin 2006/006).	Switch off the instrument and perform a reset at the touch screen/PC unit. Turn the instrument back on. In case the error persists, replace the touch srceen/PC unit. 👁 For details, see *Replacing the touch screen/PC unit* on page B-95 (see also **cobas b** 221 system Service Bulletin 009).
PC does not boot showing "Operating system not found".	Short-circuit or interrupt of the hard disk bus cable. (See also error picture D in Product Bulletin 2006/006).	Replace the hard disk bus cable. 👁 For details, see *Replacing the hard disk* on page B-99 (see also error picture D in Product Bulletin 2006/006).
PC does not boot showing "GetDriveParameters".	Short-circuit or interrupt of the hard disk bus cable. (See also error picture C in Product Bulletin 2006/006).	Replace the hard disk bus cable. 👁 For details, see *Replacing the hard disk* on page B-99 (see also error picture C in Product Bulletin 2006/006).

Table D-1 Touch screen/PC unit trouble shooting list

Error picture	Possible cause	Corrective action
PC does not boot showing "Kernel panic".	Physically destroyed sectors or inconsistent file system on the hard disk. (See also error picture B in Product Bulletin 2006/006).	Replace the hard disk and the hard disk bus cable. For details, see *Replacing the hard disk* on page B-99 (see also error picture B in Product Bulletin 2006/006).
PC does not boot showing "Give root password".	Physically destroyed sectors or inconsistent file system on the hard disk. (See also error picture A in Product Bulletin 2006/006).	Replace the hard disk and the hard disk bus cable. For details, see *Replacing the hard disk* on page B-99 (see also error picture A in Product Bulletin 2006/006).
Software shows "download error".	No PC problem. Problems with the connection between PC and µC.	Check connenction between the touch screen/PC unit and the interface unit. For details, see Figure B-66 on page B-89 and *Error 10006 "Download error"* on page D-14.
The boot process takes a very long time.	The file system is being checked.	Wait until the boot process is finished. Depending on the touch screen/PC version, this may take up to 90 minutes. The following settings are default: file system check after 6 months or 20 boot processes.

Table D-1 Touch screen/PC unit trouble shooting list

Important test routines

Contact path test

BG/ISE

☞ At the ready screen, press
[System] > [Component test] > [Control Sensors] > [Contact paths] > [BG] or
[System] > [Component test] > [Control Sensors] > [Contact paths] > [ISE].

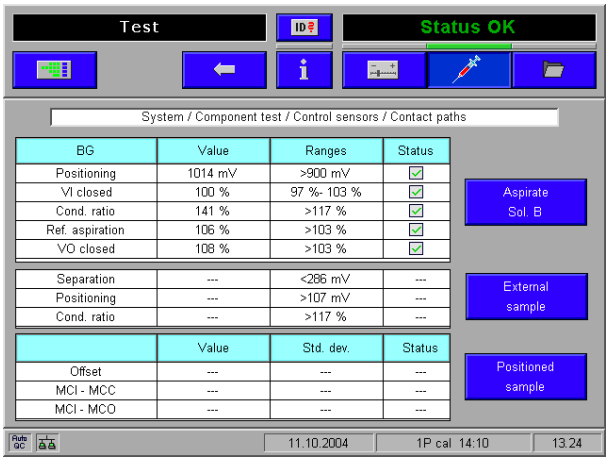


Figure D-3 Contact path test BG/ISE

Aspirate CAL B: ☞ Press [Aspirate CAL B].

Positioning: MCI-MCO contact paths

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1001 "Sample pos. error (2)"* on page D-58.

VI closed: MCO measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1008 "Irregular sample (2)"* on page D-61.

Cond. ratio: MCC-MCO contact path

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1006 "Irregular sample (1)"* on page D-60.

Ref. aspiration: MCO measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1003 "Ref. sol. asp. error"* on page D-59 and *Flag no. 1004 "Ref. sol. pos. error"* on page D-59.

VO closed: MCO measurement value

Status not ok – ☒:

- This error pattern corresponds to *Flag no. 1003 "Ref. sol. asp. error"* on page D-59 and *Flag no. 1004 "Ref. sol. pos. error"* on page D-59.

Positioned sample: ☞ Press [Positioned sample].

External sample: ☞ Press [External sample].

Separation: MCC measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1002 "Sample sep. error (1)"* on page D-59.

Positioning: MCO measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1000 "Sample pos. error (1)"* on page D-58.

Cond. ratio: MCC-MCO contact path

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1006 "Irregular sample (1)"* on page D-60.

MSS (cobas b 221<5/6> systems only)

☞ At the ready screen, press
[System] > [Component test] > [Control Sensors] > [Contact paths] > [MSS].

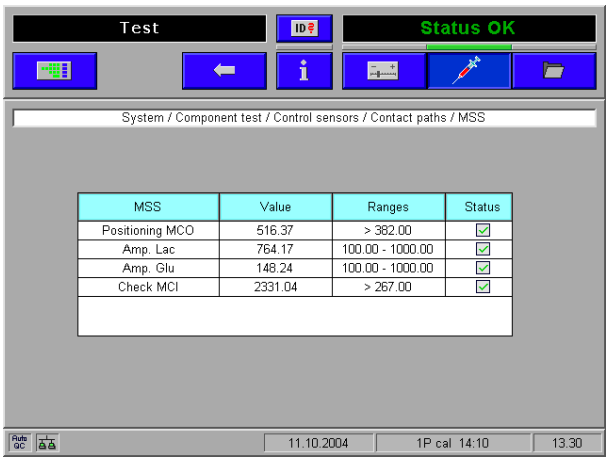


Figure D-4 Contact path test MSS (**cobas b** 221<5/6> systems only)

MSS standby solution: ☞ Press [MSS standby solution].

Positioning MCO: MCO measurement value

Status not ok – ☒:

- Call up "Aspirate MSS standby solution" in the fill routines.
- Measurement value near zero: check seating of MSS cassette.

- Measurement value slightly lower: replace MSS cassette.
- Insert electrode simulator and act accordingly.

Ref. aspiration: MCO measurement value

Status not ok – ☒:

- Call up "Aspirate MSS reference solution" in the fill routines.
- Replace S3 fluid pack.
- Call up "General fluidics test" and check tubing paths.

Amp. Lac/Glu: Amp. Lac/Glu are measurement values that have no meaning yet.

Check MCI: MCI measurement value

Status not ok – ☒:

- Call up this test several times. This value can improve greatly as a result.
- Call up MSS wetting routine.
- Call up MSS internal cleaning and then insert new MSS cassette.

Positioned sample: ☞ Press [MSS pos. sample].

This test function is only significant when using the electrode simulator.

External sample: ☞ Press [MSS external sample].

Separation MCI: MCI measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1002 "Sample sep. error (1)"* on page D-59.

Positioning MCI: MCI measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1000 "Sample pos. error (1)"* on page D-58.

Separation MCO: MCI measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1002 "Sample sep. error (1)"* on page D-59.

Positioning MCO: MCI measurement value

Status not ok – ☒:

👁 This error pattern corresponds to *Flag no. 1000 "Sample pos. error (1)"* on page D-58.

Amp. Lac/Glu: Amp. Lac/Glu are measurement values that have no meaning yet.

Check MCI: MCI measurement value

Status not ok – ☒:

- Sample is unhomogenous.

Aggregates

T&D module

☞ At the ready screen, press
[System] > [Component test] > [Aggregates] > [T&D module].

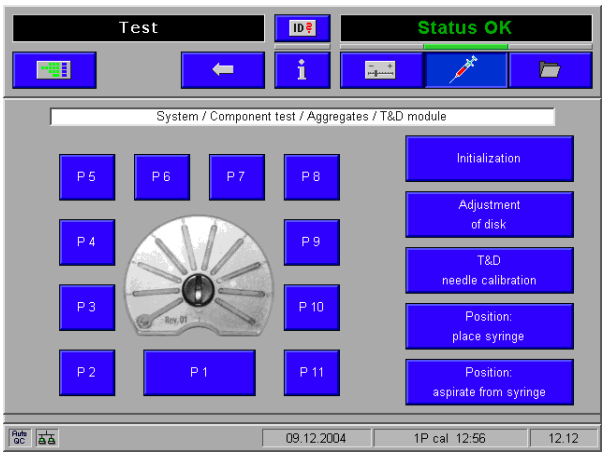


Figure D-5 T&D module test

Initialization: The T&D disc performs an automatic initialization.

Adjustment of disk: This function enables manual adjustment of an extremely twisted T&D disc

1. Move T&D disc to position 1, press "P 1".
2. Loosen retaining arm behind the T&D disc with an Allen wrench, T&D disc in pos.1, press "Adjustment of disk".
3. Move the T&D disc to the correct position like shown on the screen.
4. Then tighten the retaining arm and press "Initialization".

T&D needle calibration: This function is used for adjusting the position of the T&D disk to the SIP tip. It must be performed after replacing the SIP or the T&D tubing set.

Test SIP for leaks before needle calibration

Before performing the T&D needle calibration verify the sample inlet path and the sample needle for leaks.

1. Press "T&D needle calibration".
2. Press "Start".

Within the T&D needle calibration, the initialization is performed automatically. Through air pressure measurement with the vacuum pump and baro sensor and simultaneous positioning of the needle to a silicone area at the back side of the T&D disk, the distance between the needle and the T&D disk is calibrated. If the needle calibration fails (*Offset–Status* ☒) retry once again. If the error persists, verify that the needle tip is flat. Replace the needle if necessary.

Place syringe: This function is used to check the needle position.

It should be centered in the retainer.

If the needle projects too far, it is more difficult to attach a sample container. If the needle is too far back, there is a danger that the sample container will fall off.

If the needle is not centered in the container, a "T&D needle calibration" must be performed. If this is not successful, perform the following actions:

- Replace needle.
  👁 Replacing the needle on page 4-23.
- Replace T&D disk.
  👁 Replacing the T&D disk on page 4-26.
- Replace sample inlet path.
  👁 Replacing the sample inlet path on page 4-24.
- Replace T&D module.
  👁 Replacing the T&D module on page 4-21.

Aspirate from syringe: This function is used for visual inspection of the needle (bent, broken).

Peristaltic pumps

☞ At the ready screen, press
[System] > [Component test] > [Aggregates] > [Peristaltic pumps].

Overview This test function tests the function of the three peristaltic pumps (**cobas b** 221<1>–<4> systems only have one peristaltic pump). The following features must be noted here:

Noise check: If a pump is too loud, this indicates that the pump head may be eccentric – the pump head of the relevant pump must be replaced.

In addition, an excessively noisy pump can indicate that a pump tube is too tightly seated – the pump tube of the relvant pump must be replaced.

Direction of rotation: After replace a peristaltic pump the correct direction of rotation must be checked with the test – if the direction of rotation is reversed, the pump is incorrectly connected.

Tubing paths: This test function can often be useful as a support when testing the tubing, because it allows precise control of the pumps.

Hemolyzer (cobas b 221<2/4/6> systems only)

☞ At the ready screen, press
[System] > [Component test] > [Aggregates] > [Hemolyzer].

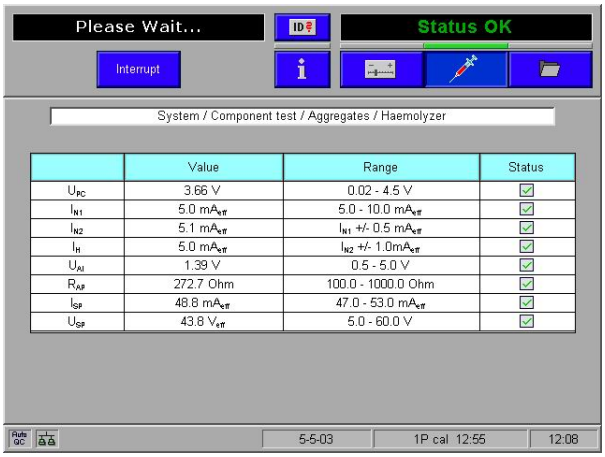


Figure D-6 Hemolyzer (**cobas b** 221<2/4/6> systems only)

U_{PC}: Phase-angle adjustment voltage

Status not ok – ☒:

- The hemolyzer is not empty: call up "Wash".
- The hemolyzer is damaged: replace unit.

I_{N1}: Current setting

Status not ok – ☒:

- The hemolyzer is damaged: replace unit.

I_{N2}: Measure setting

Status not ok – ☒:

- The HSIN board is defective: replace board.

I_H: Hemolyzer current

Status not ok – ☒:

- The hemolyzer is damaged: replace unit.
- The HSIN board is defective: replace board.

U_{AI}: Voltage at air and idle

Status not ok – ☒:

- The hemolyzer is not empty: call up "Wash".
- The hemolyzer is damaged: replace unit.

R_{AP}: Resistance with air and power

Status not ok – ☒:

- The hemolyzer is not empty: call up "Wash".

- The hemolyzer is damaged: replace unit.

I_{SP}: Current with sample and power

Status not ok – ☒:

- The hemolyzer is damaged: replace unit.
- The HSIN board is defective: replace board.

U_{SP}: Voltage with sample and power

Status not ok – ☒:

- The hemolyzer is damaged: replace unit.
- The HSIN board is defective: replace board.

References 👁 *Replacing the hemolyzer* on page B-60.
👁 *Replacing the HSIN board* on page B-61.

Control sensors

Vacuum System

☞ At the ready screen, press
[System] > [Component test] > [Control sensors] > [Vacuum system].

There are four effective test options for the vacuum system that can be used for error analysis:

- Set 200 mbar as target value and switch on pump: the underpressure should be between 170 and 230 mbar after 2 to 3 seconds. If this cannot be reached, valve V13 or the connecting tube must be checked and if necessary replaced.
- Set 400 mbar as target value and switch on pump: the underpressure should be between 360 and 440 mbar after 10 seconds. If this cannot be reached, valve V13 or the connecting tube must be checked and if necessary replaced.
- Set "max" as target value and switch on pump: the underpressure should reach at least 75% of the local Barometric Pressure as sensed on Control sensors/Baro sensor. If this is not reached, check the pump head and the VPS sensor and if necessary replace.
- Set "max" as target value, switch on pump and then off after 15 seconds: the underpressure drop should be less than 50 mbar after 30 seconds. If this is not reached, there is a leak in the vacuum system: check tightness of vacuum pump, tube connections, moisture trap, VPP, V13, V18, V6, V23, main pump, waste separator and if necessary replace.

Baro sensor

☞ At the ready screen, press
[System] > [Component test] > [Control sensors] > [Baro sensor].

The value of the Baro sensor must match the actually measured Baro value (with a calibrated barometer). If the deviation is greater than 4 mbar, the Baro value must be input again in the protected setup.

👁 For instructions, see *Baro settings* on page B-5.

From approx. 3000 m above sea level or air pressure < 526 mmHg (70.13 kPa), the specifications for parameter PO_2 are no longer fulfilled and the parameter must no longer be used for evaluation of the clinical decisions.

After successful installation, the parameter must be permanently deactivated!

Sample Sensors

☞ At the ready screen, press [System] > [Component test] > [Control sensors] > [Sample sensors].

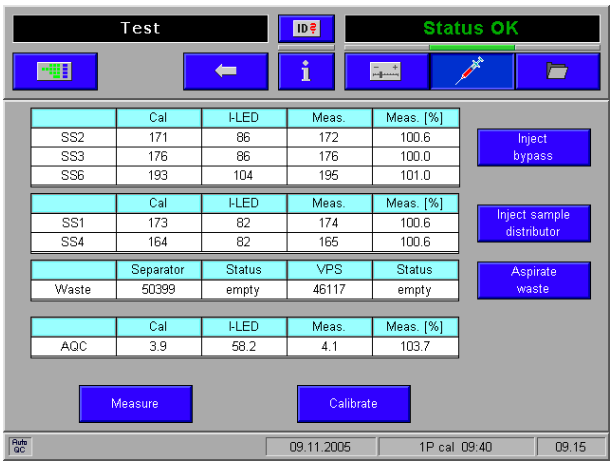


Figure D-7

Use this test to check the optical sample sensors of the sample distributor, the Hb cartridge, the AutoQC module, the waste separator and the vacuum pump protector.

Item	Description
Cal	Air calibration value
I-LED	LED current in mA, < 255 mA
Meas.	Measured value
Meas. [%]	Measured value related to air value
Separator	Waste sensor measured value
VPS	VPS measurement value
Status	Fill status of waste separator or VPS

Table D-2

Measure: The measured values of all sample sensors are refreshed with the measuring medium located in the sample path. If no sample was injected, the displayed measurement values are valid for the empty sample sensor (air).

Inject bypass: Inject a sample and press [Measure]. The measured values of sample sensors are redetermined. A significantly lower value will be displayed with injected sample.

Inject sample distributor: Inject a sample and press [Measure]. The measured values of sample sensors are redetermined. A significantly lower value will be displayed with injected sample.

Aspirate waste: The measured values of the waste separator sensor are determined.

Calibrate: The sample sensors are calibrated with the measuring medium located in the sample path (normally with air). The air calibration will set the sample sensor values to 100 %.

High values for I-LED when injecting and measuring water indicate clogged sample sensors, bent or not corectly plugged light guides.

Meas. sensors

BG

☞ At the ready screen, press [System] > [Component test] > [Meas. sensors] > [BG].

Use this function to monitor the BG module.

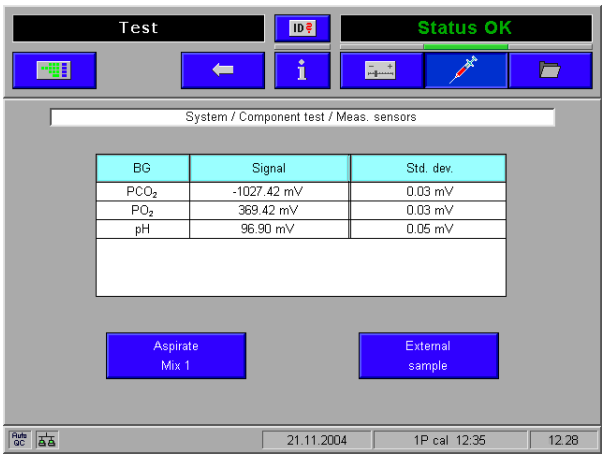


Figure D-8 BG

Overview The current sensor values will be displayed in the column "Signal". Standard deviation in column "Std. dev." must not exceed the follwing values for optimal aspiration of Mix 1:

Sensor	Signal from[mV]	Signal to [mV]	Std. dev. [mV]
PCO_2	-1300	2000	1.5
PO_2	--	--	1.5
pH	-2100	1600	3

Table D-3

Aspirate Mix 1: ☞ Press [Aspirate Mix 1].

Mix 1 will be positioned into the measurement chamber.

External sample: ☞ Press [External sample].

An external sample will be positioned into the measurement chamber.

The boundaries provided for standard deviation are valid for Mix 1 only!

ISE

☞ At the ready screen, press [System] > [Component test] > [Meas. sensors] > [ISE].

Use this function to monitor the ISE module.

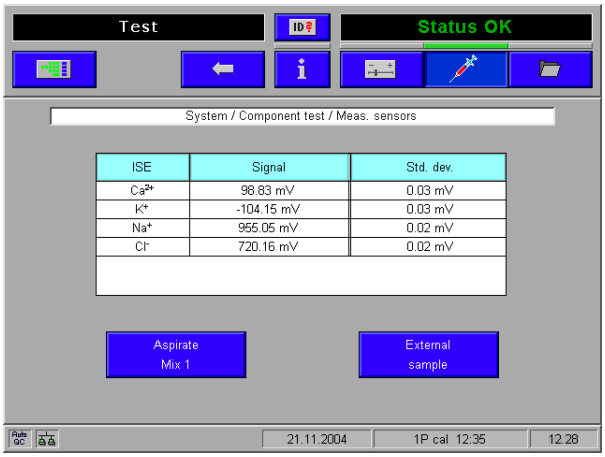


Figure D-9 ISE

Overview The current sensor values will be displayed in the column "Signal". Standard deviation in column "Std. dev." must not exceed the follwing values for optimal aspiration of Mix 1:

Sensor	Signal from[mV]	Signal to [mV]	Std. dev. [mV]
Ca^{2+}	-2000	2200	1.2
K^{+}	-1700	2100	1.2
Na^{+}	-1700	2300	1.2
Cl^{-}	-2300	1700	1.2

Table D-4

Aspirate Mix 1: ☞ Press [Aspirate Mix 1].

Mix 1 will be positioned into the measurement chamber.

External sample: ☞ Press [External sample].

An external sample will be positioned into the measurement chamber.

The boundaries provided for standard deviation are valid for Mix 1 only!

MSS

☞ At the ready screen, press [System] > [Component test] > [Meas. sensors] > [MSS].

Use this function to monitor the MSS module.

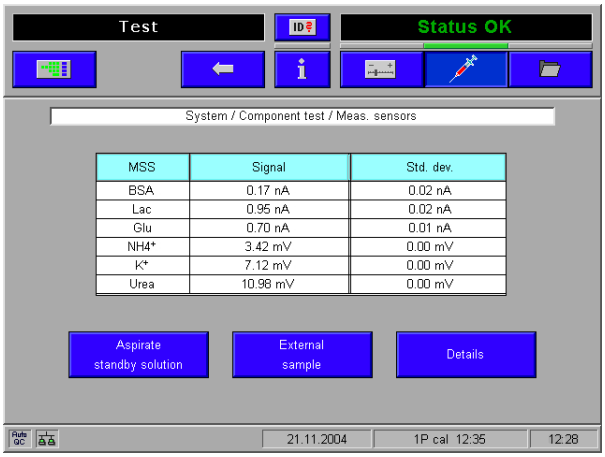


Figure D-10 MSS

Overview

The current sensor values will be displayed in the column "Signal". Standard deviation in column "Std. dev." must not exceed the follwing values for optimal aspiration of MSS standby solution:

Sensor	Signal from	Signal to	Std. dev.
BSA	-10 nA	100 nA	0.8 nA
Lac	-10 nA	100 nA	0.4 nA
Glu	-10 nA	100 nA	0.4 nA
NH_4	-100 mV	100 mV	0.2 mV
K^+	-100 mV	100 mV	0.2 mV
Urea	-100 mV	100 mV	0.2 mV

Table D-5

The boundaries provided for standard deviation are valid for MSS standby solution only!

Aspirate MSS standby solution:

☞ Press [Aspirate standby solution].

MSS standby solution will be positioned into the measurement chamber.

External sample:

☞ Press [External sample].

An external sample will be positioned into the measurement chamber.

Adjust MSS:

☞ Press [Details] > [Adjust MSS].

For instruments with urea installed only. Adjusts the potentiometry offset of the measurement amplifier to fit the ADC range. This function is automatically performed during "System Calibration".

tHb/SO_2 (cobas b 221<1/3/5> systems only)

☞ At the ready screen, press
[System] > [Component test] > [Meas. sensors] > [tHb/SO_2].

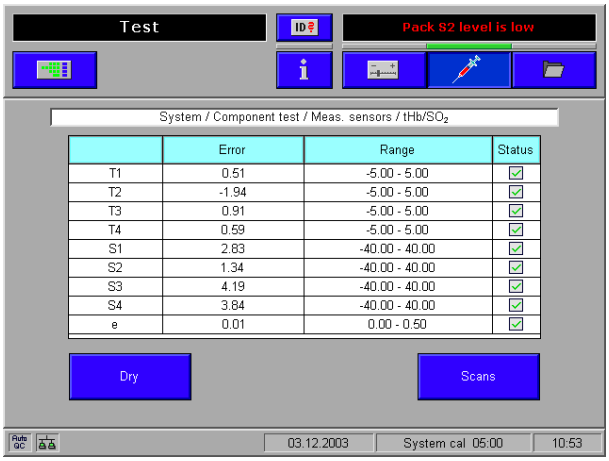


Figure D-11 tHb/SO_2 (**cobas b** 221<1/3/5> systems only)

Overview Use this function to monitor the tHb/SO_2 module.

Positioning: S1 Rinse Solution is positioned in the module.

Scans: This button starts the monitoring process which determines the values for transmissionlight and light scatter (each for wavelengths 1 to 4) and the characteristic value for the scan.

Dry: The tHb/SO_2 module is dried.

The test result (*ok* – ☑ / *not ok* – ☒) is displayed under *Status*.

If a large negative error value is displayed for one of the diodes (1 to 4) for transmission light (T) as well as scattered light (S), it indicates that a laser diode is defective.

👁 This type of error corresponds to *Flag no. 2071 "Measuring path dirty"* on page D-78.

COOX (cobas b 221<2/4/6> systems only)

☞ At the ready screen, press
[System] > [Component test] > [Meas. sensors] > [COOX].

Overview Use this function to monitor the oximeter module.

Lamp test – Halogen lamp: Activate *Halogen lamp* (green switch). When the test is complete, the values and the status (*ok* – ☑ / *not ok* – ☒) are displayed in the table.

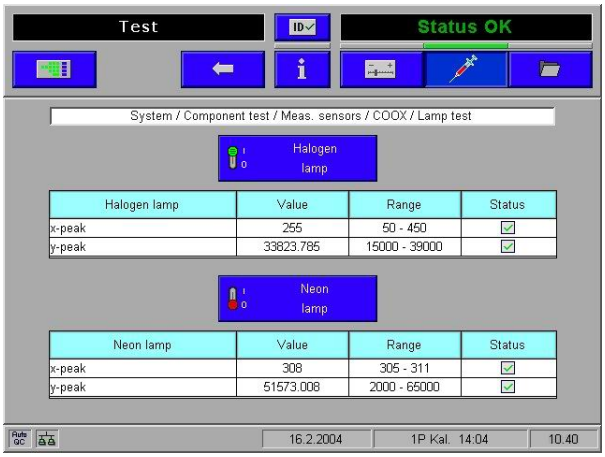

Test
ID
Status OK
System / Component test / Meas. sensors / COOX / Lamp test
Halogen lamp
Halogen lamp | Value | Range | Status
x-peak | 255 | 50 - 450
y-peak | 33823.785 | 15000 - 39000
Neon lamp
Neon lamp | Value | Range | Status
x-peak | 308 | 305 - 311
y-peak | 51573.008 | 2000 - 65000
16.2.2004
1P Kal. 14:04
10.40

Figure D-12 Lamp test (Halogen lamp-green)

Status not ok – ☒:

If an error value is displayed on the halogen lamp x-peak, it indicates a grid shift (photodiode array movement). If necessary replace the polychromator bilirubin.

👁 This error pattern corresponds to *Flag no. 6032 "Halogen lamp not OK"* on page D-83.

Lamp test – Neon lamp: Activate *Neon lamp* (green switch). When the test is complete, the values and the status (*ok* – ☑ / *not ok* – ☒) are displayed in the table.

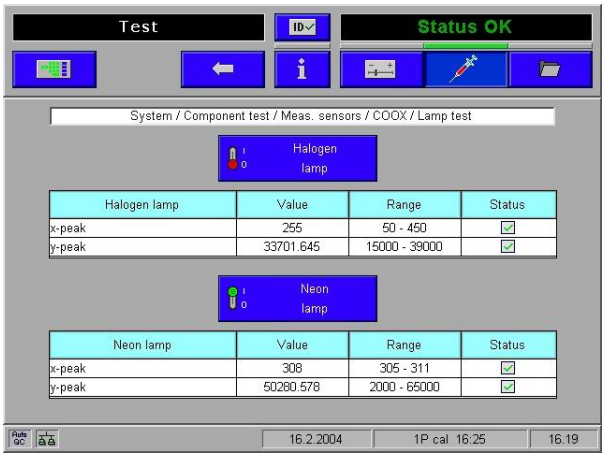

Test
ID
Status OK
System / Component test / Meas. sensors / COOX / Lamp test
Halogen lamp
Halogen lamp | Value | Range | Status
x-peak | 255 | 50 - 450
y-peak | 33701.645 | 15000 - 39000
Neon lamp
Neon lamp | Value | Range | Status
x-peak | 308 | 305 - 311
y-peak | 50280.578 | 2000 - 65000
16.2.2004
1P cal 16:25
16.19

Figure D-13 Lamp test (Neon lamp-green)

Status not ok – ☒:

The light output of the neon lamp is too low.

If an error value is displayed on the neon lamp x-peak, it indicates a grid shift (photodiode array movement). If necessary replace the polychromator bilirubin.

👁 This error pattern corresponds to *Flag no. 6031 "Neon lamp not OK"* on page D-83.

Optical status: Use this function to check the polychromator.

When the test is complete, the values and the status (*ok* – ☑ / *not ok* – ☒) are displayed in the table.

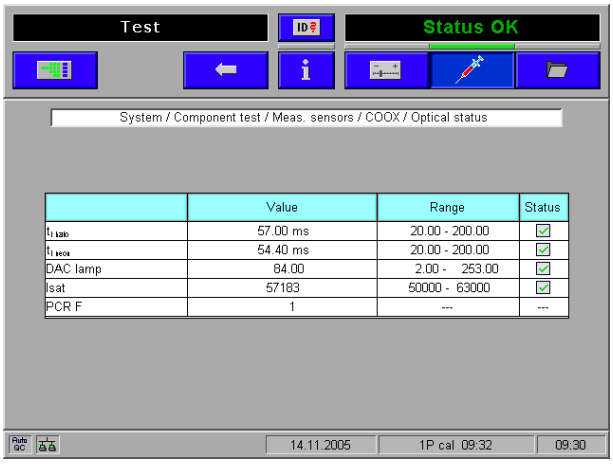


Figure D-14 COOX optical status

Status not ok – ☒:

If an error value is displayed perform the following actions:

- Check primary light guide for damage and if necessary replace it.
  For instructions, see *Replacing the primary light guide* on page B-56.
- Replace polychromator bilirubin.
  For instructions, see *Replacing the Polychromator Bilirubin* on page B-54.

General fluidics test

☞ At the ready screen, press [System] > [Diagnostics] > [General fluidics test].

*The general fluidics test described below applies to **cobas b** 221<5/6> systems!*
*For **cobas b** 221<1>–<4> systems, the number of areas in which fluidics tests can be performed is reduced accordingly.*

The vacuum pump is not tested within the general fluidics test.
For instructions, *see Vacuum System on page D-101.*

Overview

The general fluidics test divides the **cobas b** 221 system into 11 ranges and performs fluid tests in these ranges. The test results are displayed on the screen. The possible test results are as follows:

- *Ok* – The test for that section could not find any errors.
- *Leak* or *blocked* – The range that has a leak or is blocked is shown exactly; the error can be found in this range.
- *Unknown* – An error was detected that is not directly in this range but only affects this range.
- *Error* – The range could not be tested because of errors in other ranges.

If errors are found, the relevant range must be tested for leakage or blockage from the following diagrams. The 11 ranges of the general fluidics test are classified as followed.

Low pressure is built up between waste separator and main pump. To test for tightness, the tested section is kept closed and the vacuum is measured with the baro sensor. To test for blockages, the corresponding section is opened and the vacuum reduction is measured with the baro sensor.

Starting the test: ☞ Press [Start].

Printout: At the result screen of the general fluidics test, press ☞ [Print].

Separator main pump range

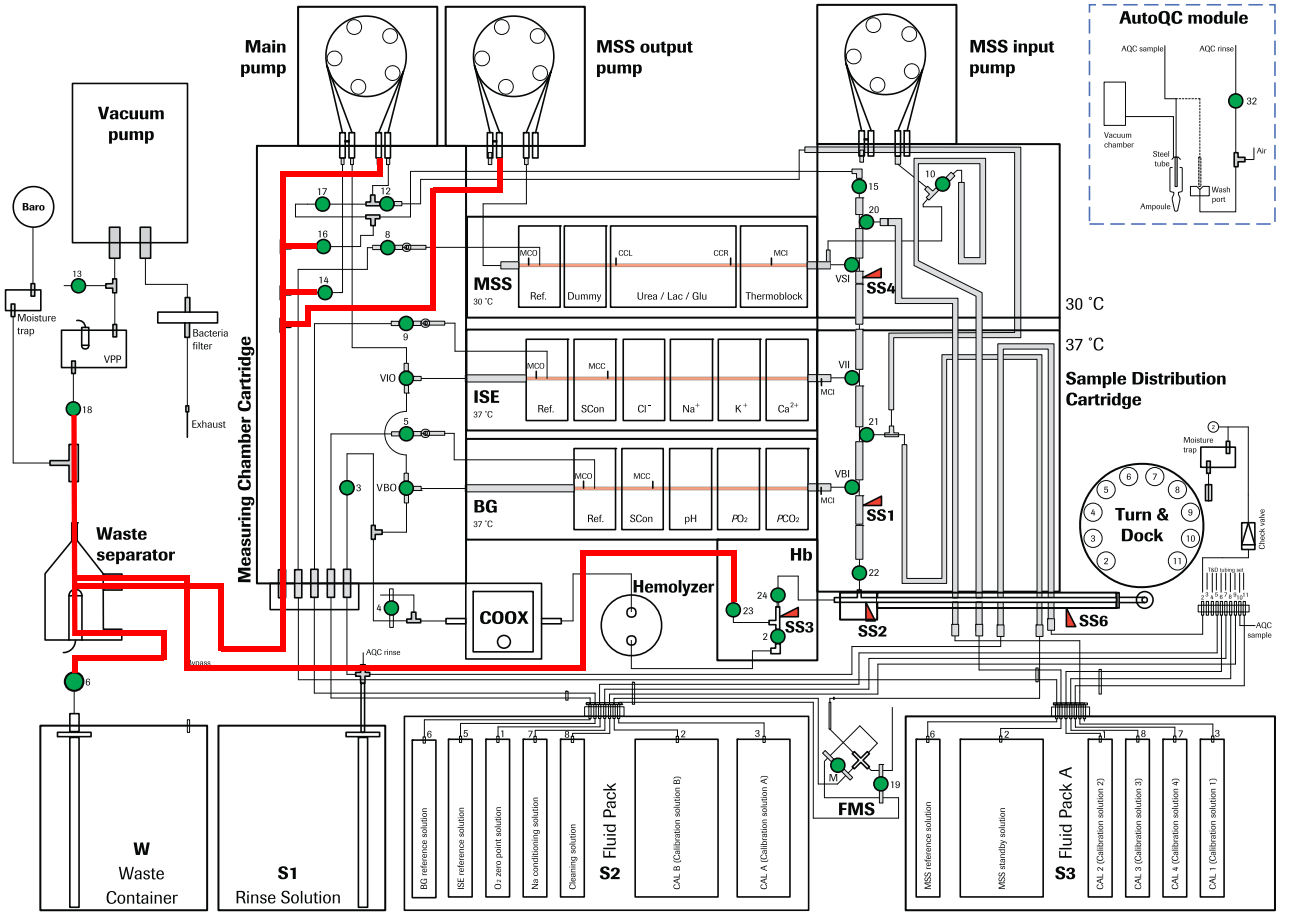


Figure D-15 Separator main pump range

Sample distributor range

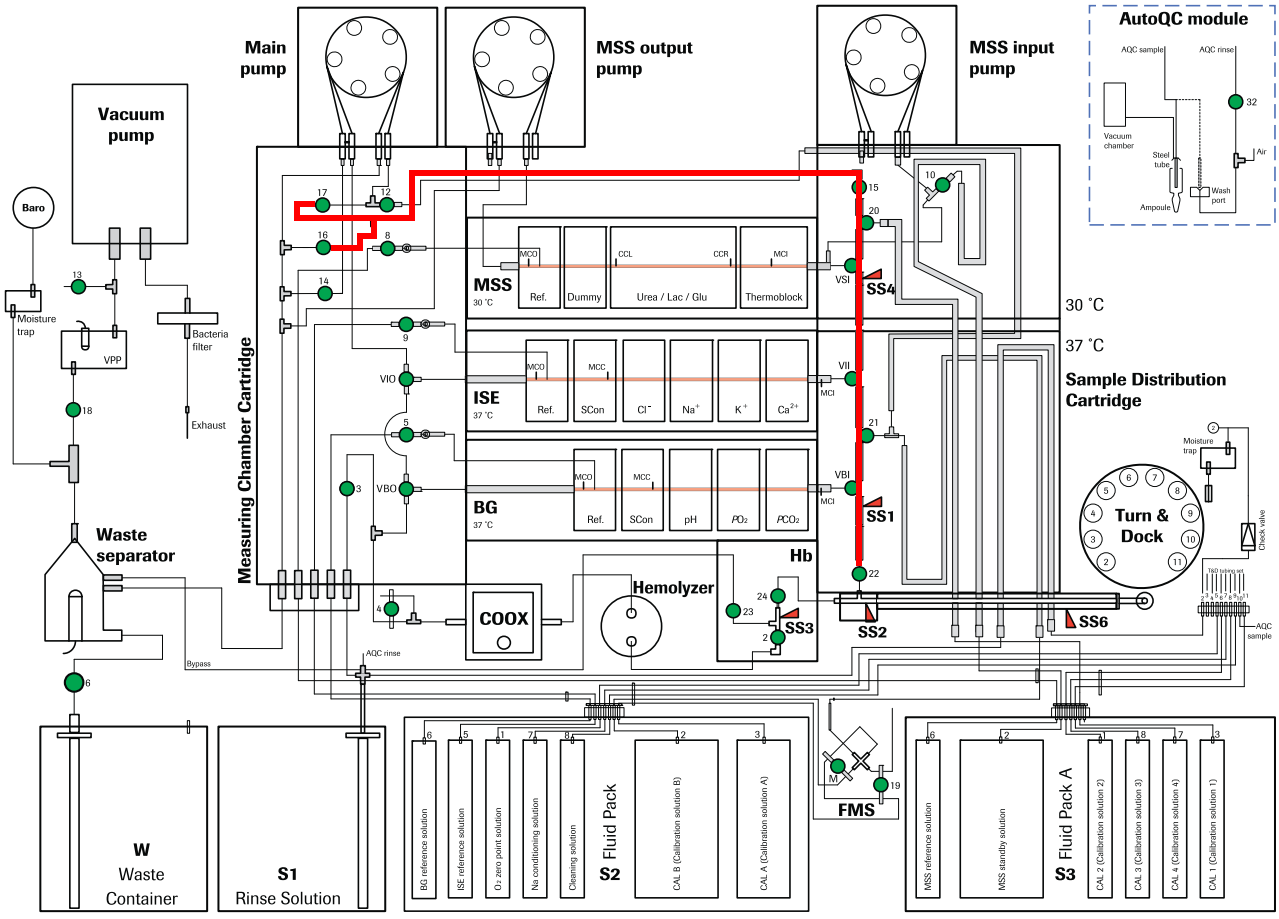


Figure D-16 Sample distributor range

FMS range

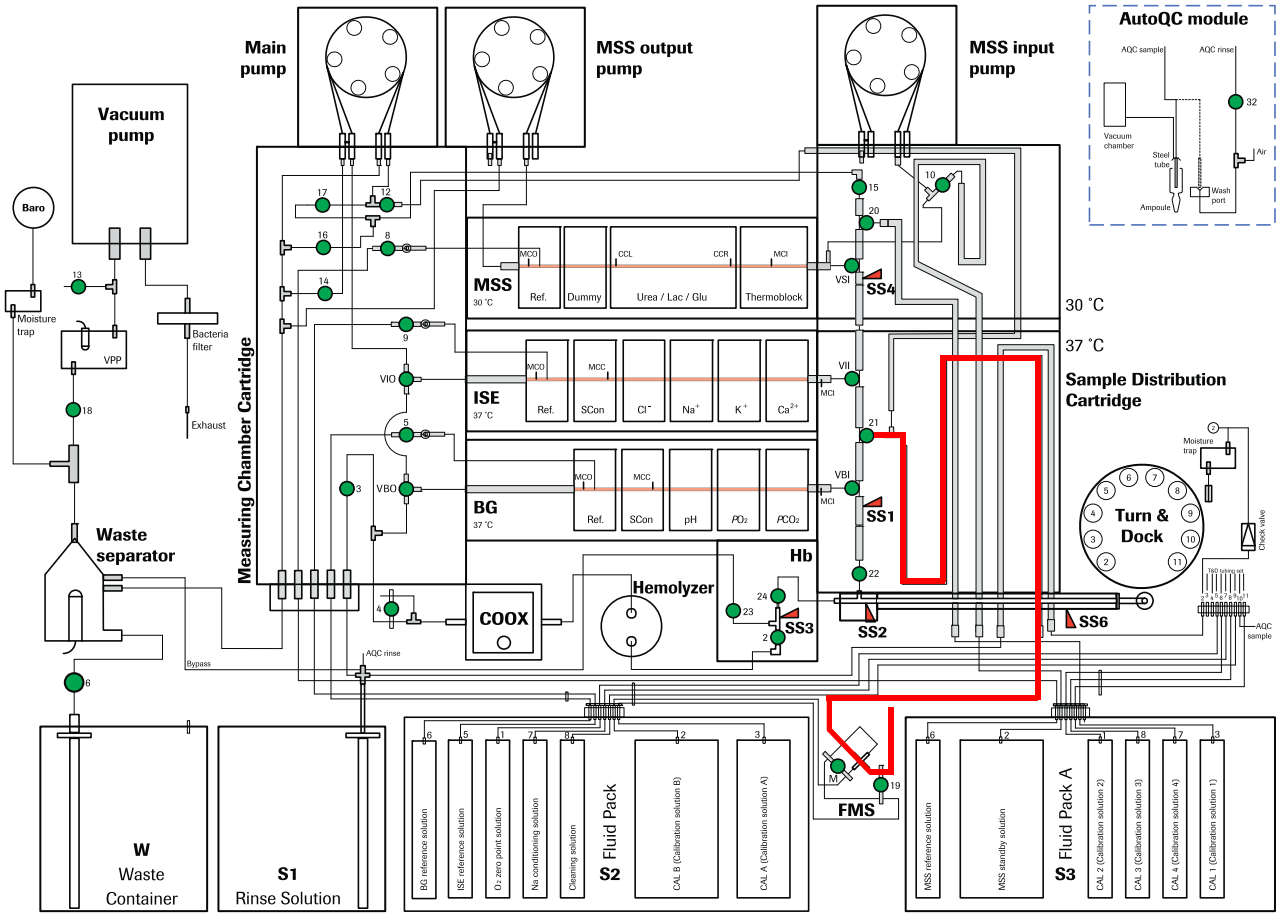


Figure D-17 FMS range

MSS measuring chamber range

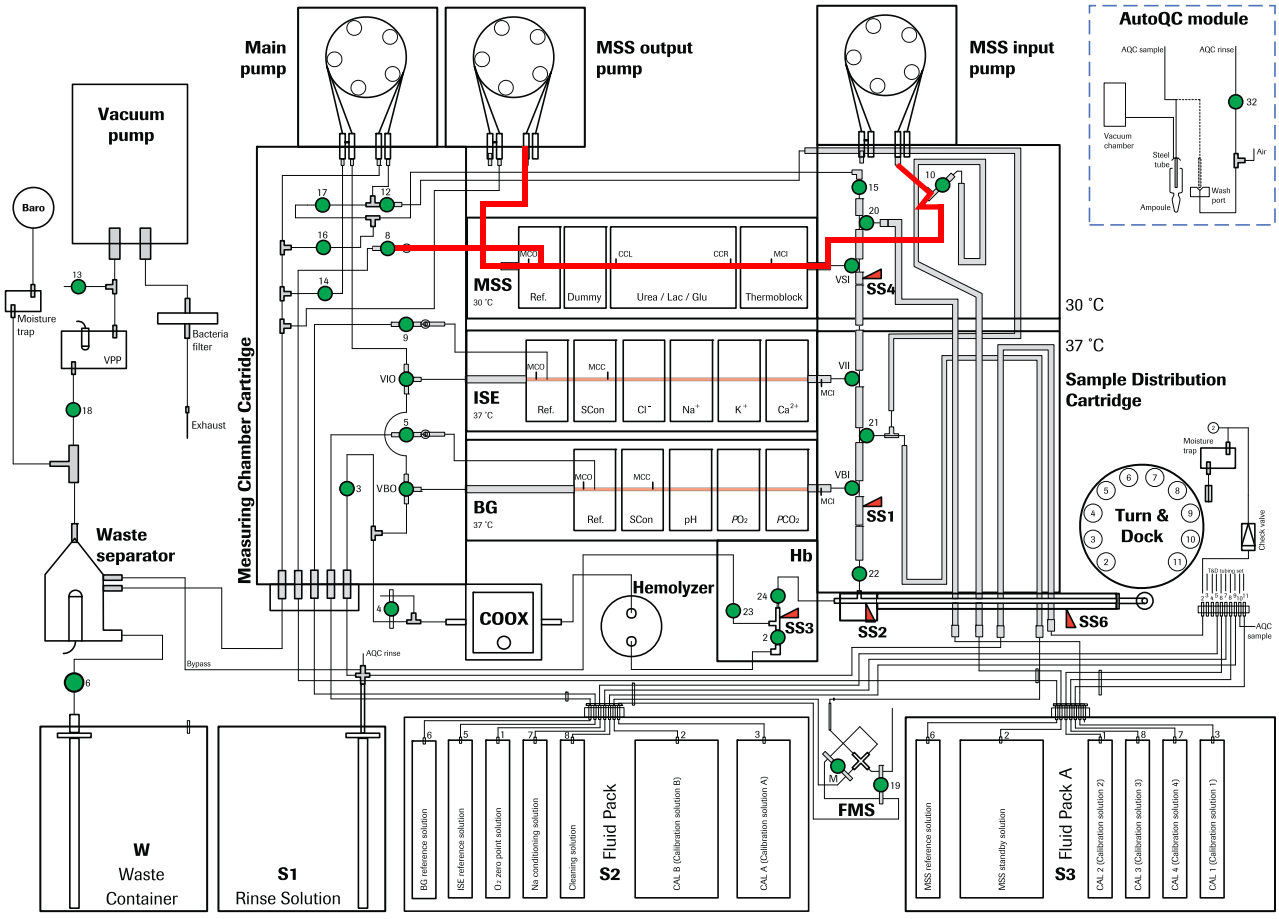


Figure D-18 MSS measuring chamber range

Sample input range

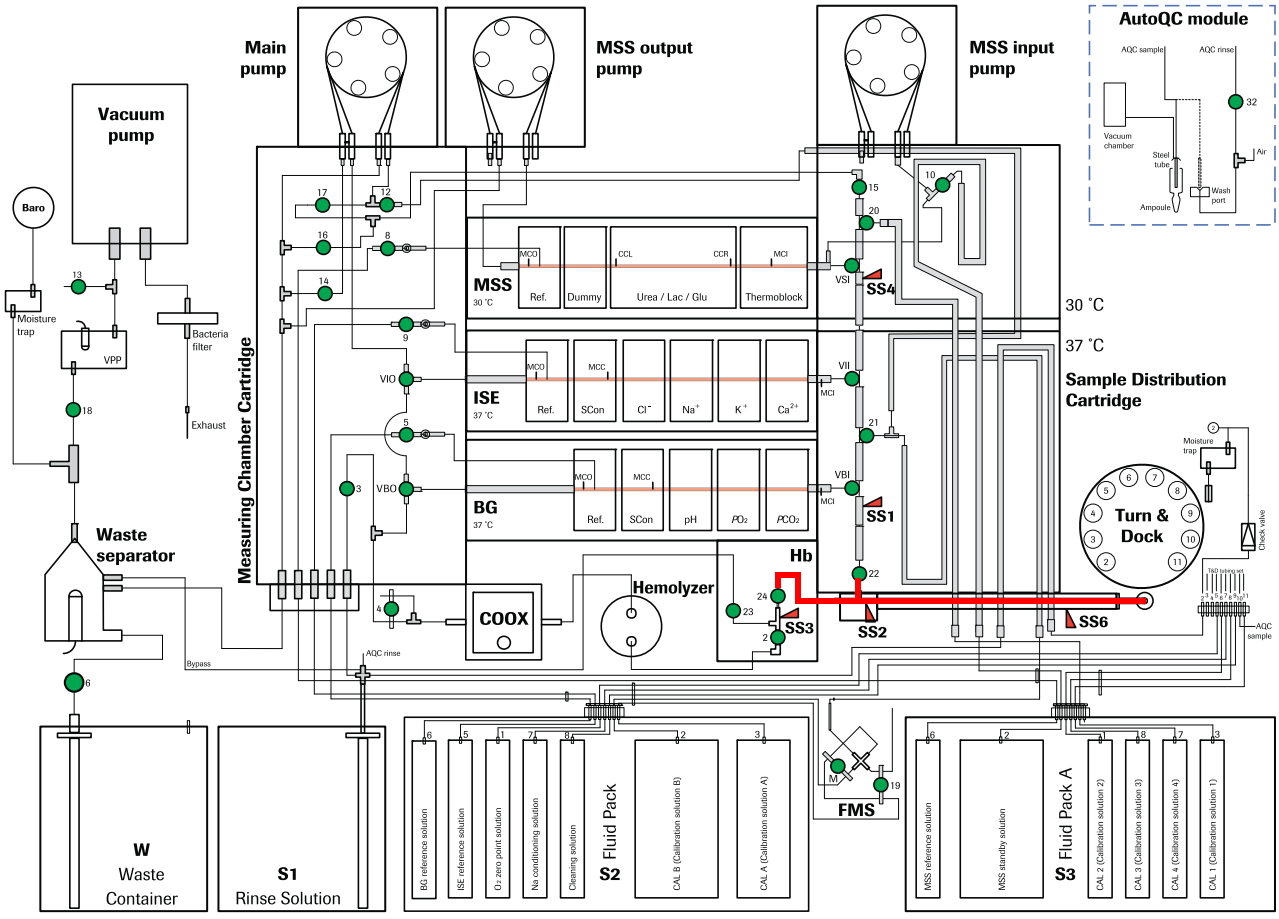


Figure D-19 Sample input range

SS2 - SS3 range

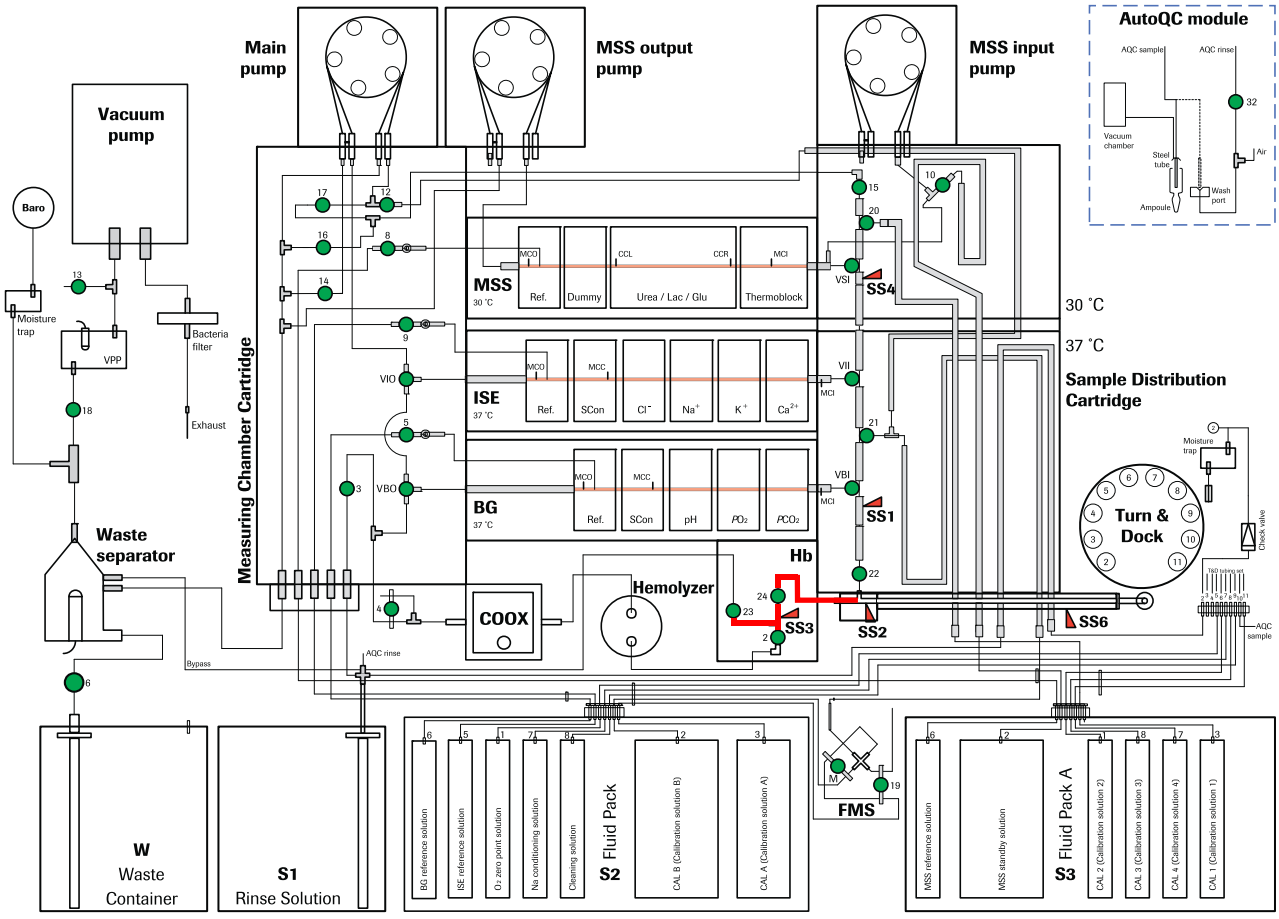


Figure D-20 SS2 - SS3 range

Converting line range

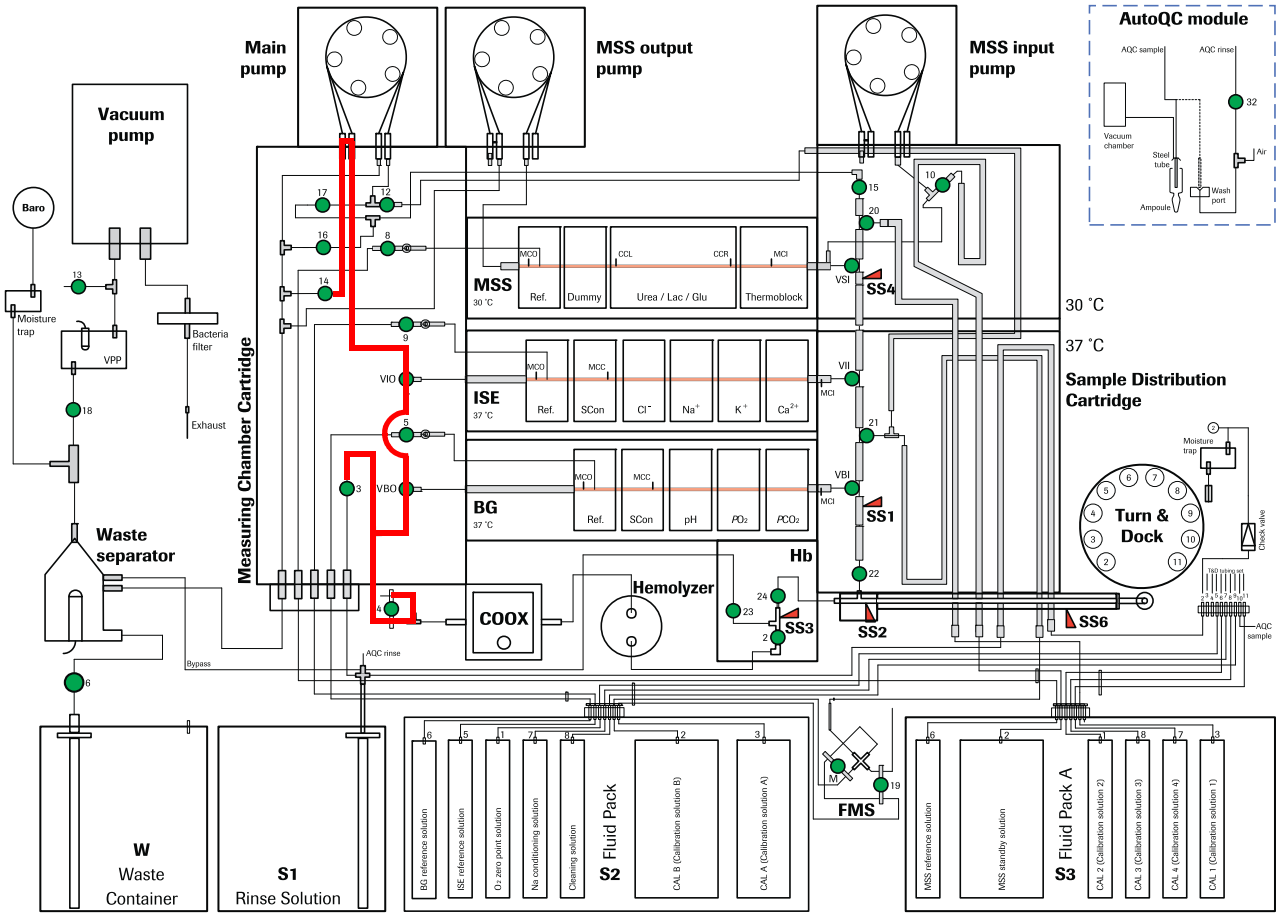


Figure D-21 Converting line range

BG measuring chamber range

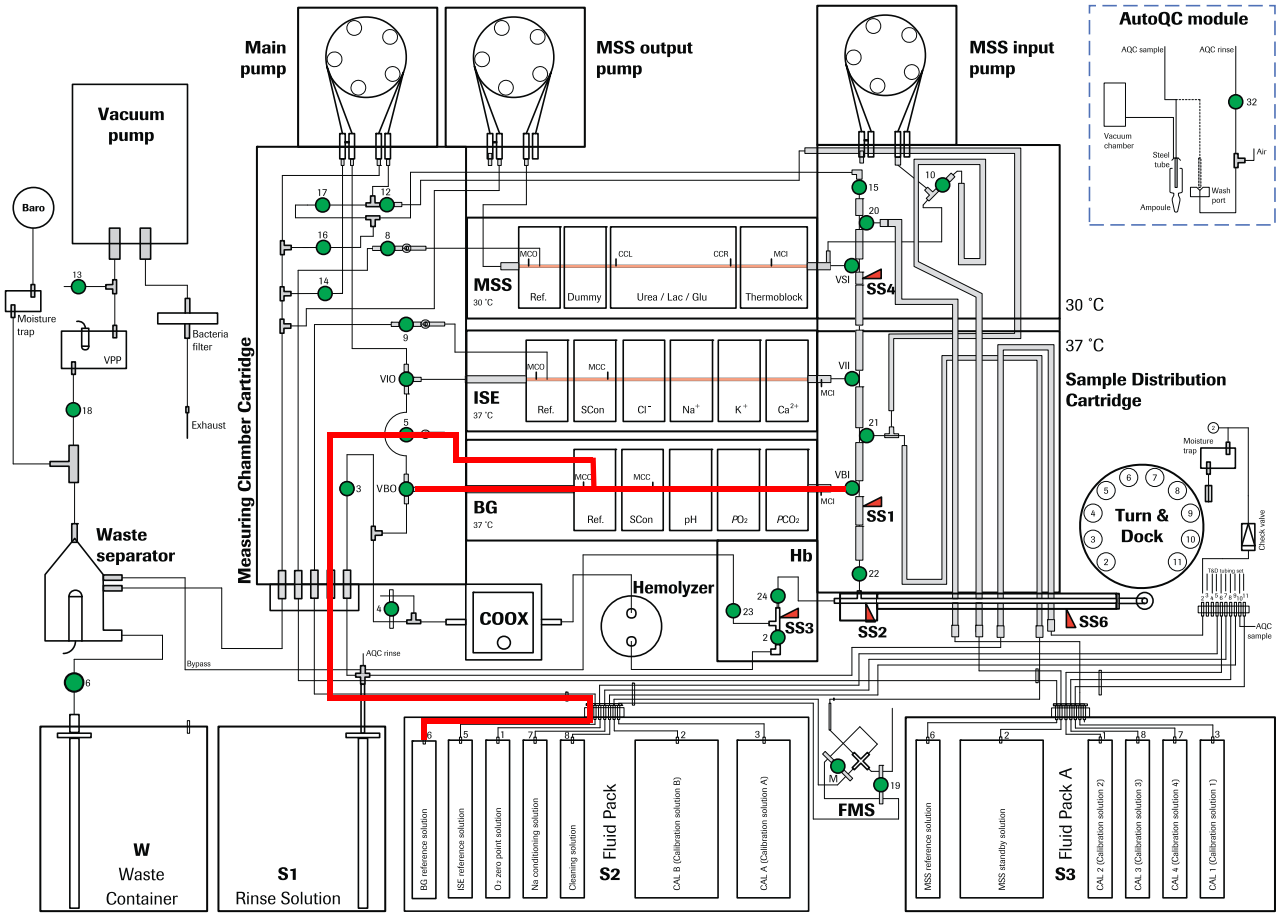


Figure D-22 BG measuring chamber range

ISE measuring chamber range

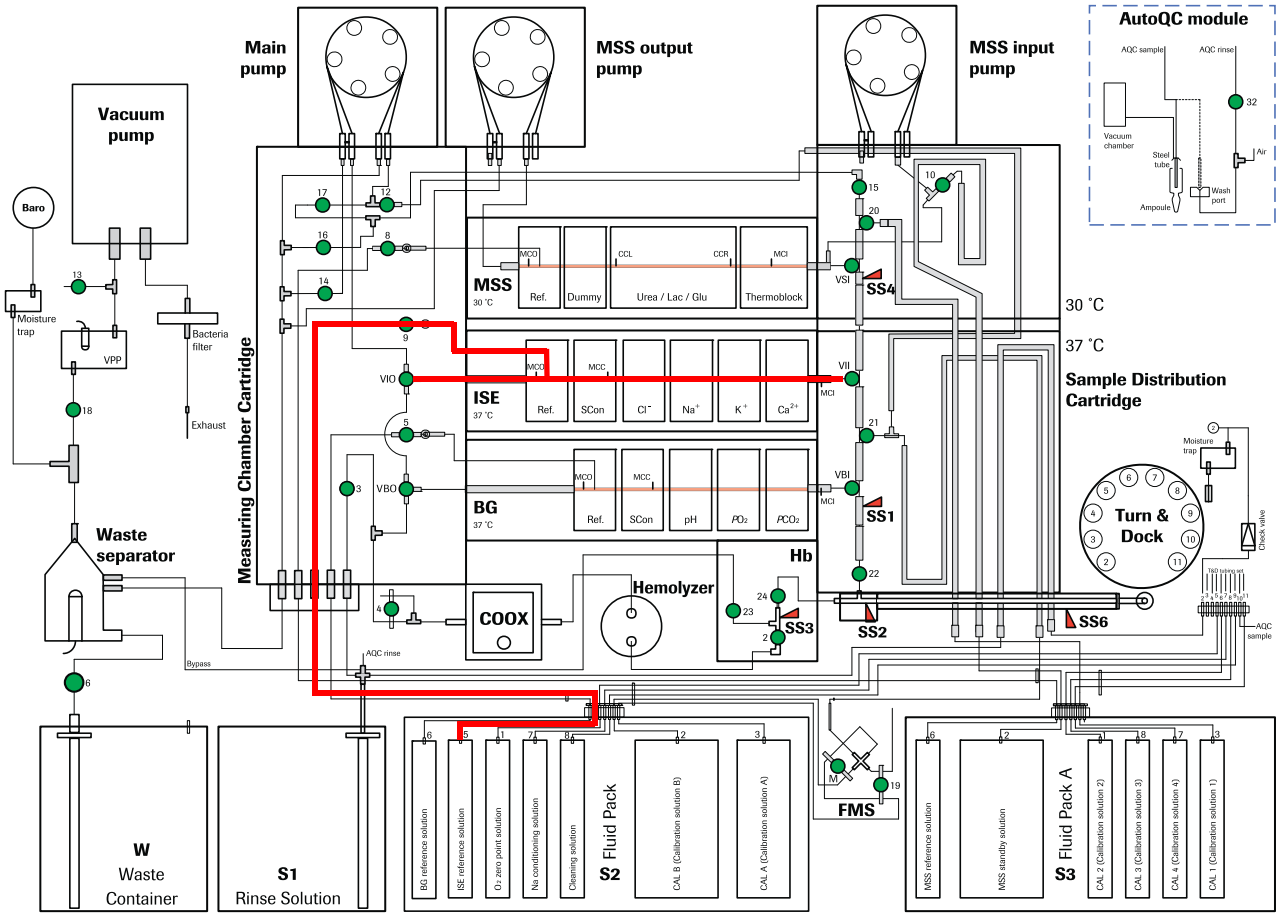


Figure D-23 ISE measuring chamber range

Hb module range

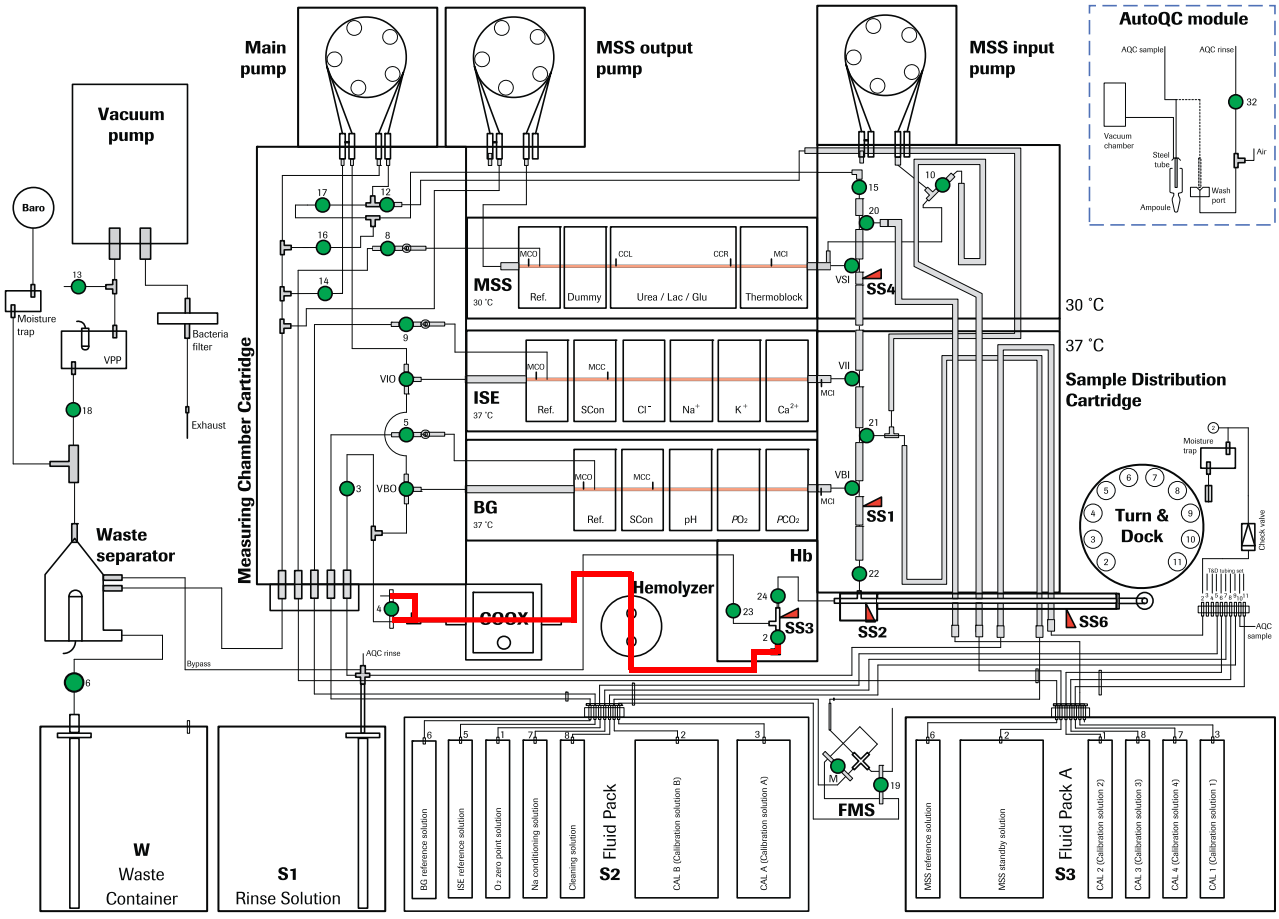


Figure D-24 Hb module range

Bypass range

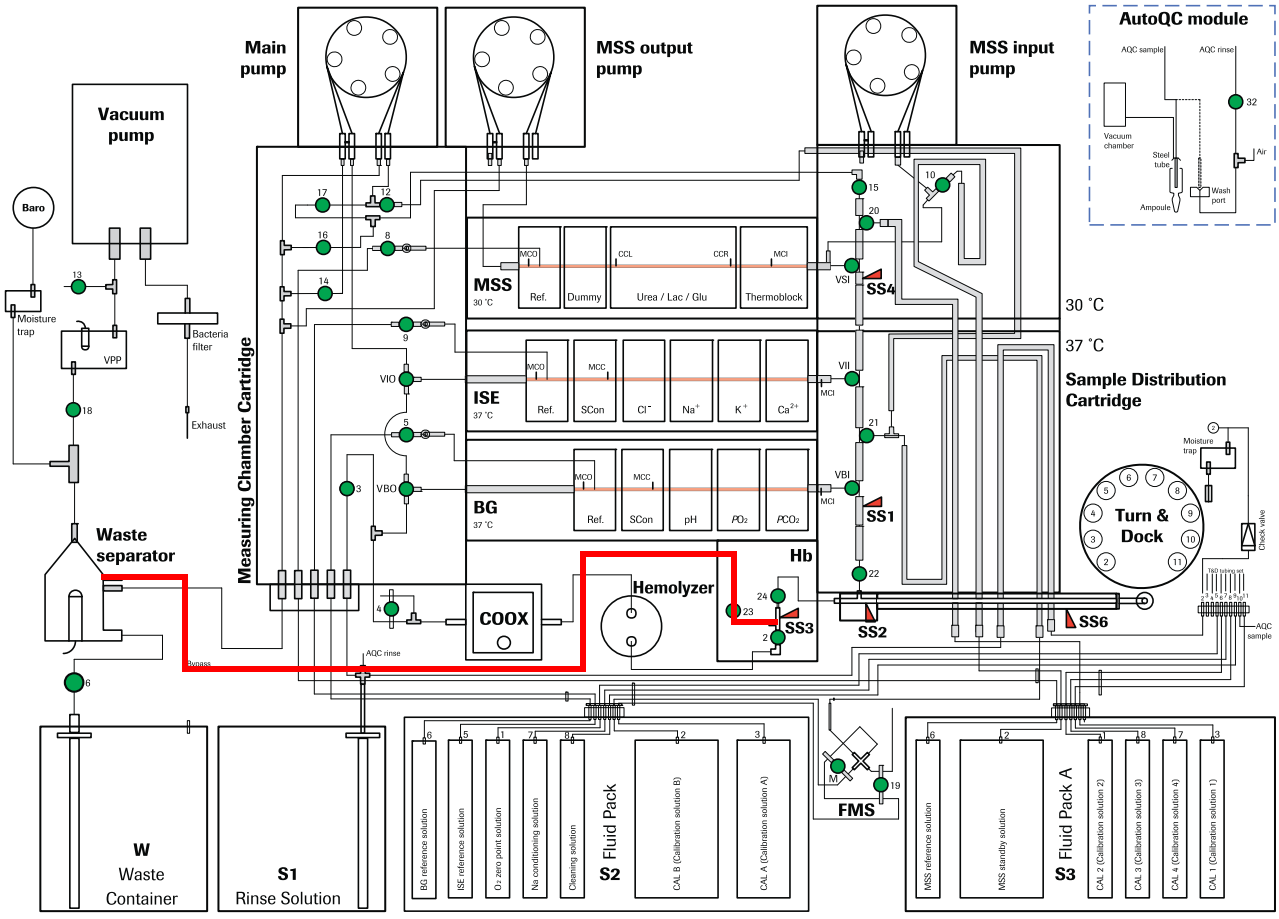


Figure D-25 Bypass range

Stability monitor

☞ At the ready screen, press [System] > [Diagnostics] > [Stability monitor].

Overview The stability monitor provides information about the instrument stability of the **cobas b** 221 system over a defined period based on the content of the log file. The default period for the stability monitor is two days.

Stability monitor

14.11.2007 09:02
Serial number : 1018
Instrument ID : 8
40329055

Start time 24.10.2007 13:31
Stop time 14.11.2007 09:01

Aspiration status	1376	found	Ok
Media	Cycles	Type of error	Error
BG Mix 1/2	225	Ref. Sol asp. error	1
BG Mix 1/2	225	Ref. Sol pos. error	3

Electrode status	1713	found	nOk
Parameters	Standard deviation	Message	Appearance
pH	158	Repro. not OK	14
Ca^{2+}	151	Sensor signal is drifting	1

Electrode voltage scanning	3332	found	nOk
Parameters			Error
Ca^{2+}			5

Standard deviation	3267	found	Ok
Parameters		Standard deviation	Interference
Glu		422	1

Standard deviation spec.	562	found	Ok
Meas. chamber	Standard deviation	Interference	Error
ISE		281 Air bubbles	1

Electrode slope	97	found	nOk
Parameters	2P cal		Sensitivity low
PCO_2	10		1

Conductivity drift	548	found	Ok
Meas. chamber		Conductivity meas.	Drift too big
ISE		270	3

Temperature drift	6237	found	nOk
Meas. chamber	Temperature measurement		Deviation
BG measuring chamber cover		372	9
BG SCon		372	18

FMS stability	267	found	nOk
Meas. chamber		Cycles	Error
BG		157	28
ISE		110	16

Figure D-26 Stability monitor printout (example)

Item	Description
Name	description of the test
# found	sum of all entries for the test
Appearance/ Error	• number of entries for the test • --- too less information, use a longer time period/press [Start]
Status	• *Ok* ☑ test was ok • *nOk* ☒ test was not ok – see test details • --- too less information, use a longer time period/press [Start]

Table D-6 Overview of the stability monitor

► To start the stability monitor...

1 Set the start day and start time as well as the stop day and stop time.

2 ☞ Press [Start].

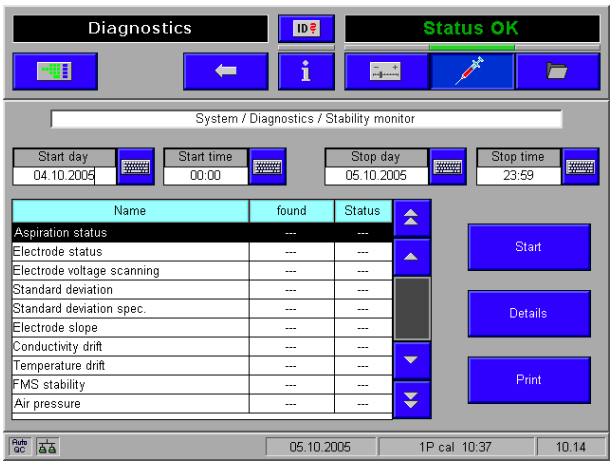


Figure D-27 Stability monitor

The results will be displayed after a short time, showing the status for each test: *Ok* – ☑ / *nOk* – ☒ / *too less information* – "---". Refer to the *found* column on the overview screen or on the printout for the total number of entries for each test.

Details: ☞ Press [Details] for a more detailed view of the selected test.

Print: At the result screen of the stability monitor, press ☞ [Print].

👁 See Figure D-26 Stability monitor printout (example) on page 7-120.

The following limit values are used for the assessment.

Aspiration status

Evaluates the error probability of aspiration- and positioning procedures of calibration solutions.

Possible error causes: leaky or blocked tubing paths, defective sample sensors or defective contact paths.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Media	medium that caused the aspiration error
Cycles	total number of aspirations of the media
Type of error	indication of the error; ☞ press [Details] for troubleshooting information
Error	number of errors with the media

Table D-7 Aspiration status details

The aspiration status is shown as number of aspiration error entries. Each of the following limits (in percentage) has to be fulfilled:

Medium	Limit value
Mix1	< 5 %
Mix2	< 20 %
O_2 zero	< 30 %
Standby solution	< 5 %
MSS CAL 1	< 5 %
MSS CAL 2	< 10 %
MSS CAL 3, CAL 4	< 30 %
Na Cond	< 30 %
Clean	< 30 %

Table D-8 Aspiration status evaluation

The D1, D2 and D3 cycles are evaluated same as MSS standby solution.

Electrode status

Evaluates the continuity (calibration values of different cycles), drift and stability of the calibration values.

Possible error causes: wrong sample medium, old/defective/contaminated electrodes.

Stability monitor limits

The stability monitor uses smaller limits than the applied limits to the instrument in order to recognize problems at an early stage.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Parameters	affected parameters Each parameter may be listed more than once due to different electrode status messages.
Standard deviation	number of parameter messages If a parameter is listed more than once, each entry shows the totals for this parameter.
Message	indication of the error; ☞ press [Details] for troubleshooting information
Appearance	number of parameter errors

Table D-9 Electrode status details

The electrode status is shown as number of electrode error entries in terms of quality of the sensor. For each sensor, the following limit (in percentage) applies:

Sensor	Limit value
all	< 10 %

Table D-10 Electrode status evaluation

Electrode voltage scanning

Evaluates the characteristics of the adjusting curve of the electrode signals (during each aspiration cycle).

Possible error causes: defective measuring chamber electronics, contamination in case of PO_2 electrode.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Parameters	affected parameters
Error	number of parameter errors

Table D-11 Electrode voltage scanning details

The electrode voltage scanning is shown as number of errors in the selected period. For each parameter, the following limit (in percentage) applies:

Sensor	Limit value
all	< 5 %

Table D-12 Electrode voltage scanning evaluation

Standard deviation

Evaluates the measuring quality (standard deviation) of several single measurement points of the electrode adjusting curve.

Possible error causes: Air bubbles in the inner electrolyte of the electrodes, defective grounding, defective measuring chamber electronics.

Stability monitor limits

The stability monitor uses smaller limits than the applied limits to the instrument in order to recognize problems at an early stage.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Parameters	affected parameters
Standard deviation	number of parameter messages
Interference	number of parameter errors

Table D-13 Standard deviation details

The standard deviation is shown as number of errors in the selected period. For each parameter, the following limit (in percentage) applies:

Sensor	Limit value
all	< 10 %

Table D-14 Standard deviation evaluation

Standard deviation spec.

Similar to the electrode voltage scanning. Evaluates the measuring quality (standard deviation) of several single measurement points of the electrode adjusting curve. If the standard deviation increases with the distance to the reference electrode, cross currents are concerned. If the standard deviation is insufficient at all ISE electrodes the reference electrode is concerned or air bubbles are present in the sample path.

Possible error causes: defective measuring chamber electronics, defective reference electrode, wetting problems.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Meas. chamber	affected measuring chamber Each parameter may be listed more than once due to different electrode status messages.
Standard deviation	number of measuring chamber messages
Interference	indication of the error; ☞ press "Details" for troubleshooting information
Error	number of measuring chamber errors

Table D-15 Standard deviation spec. details

The standard deviation spec. is shown as number of errors in the selected period. For each measuring chamber, the following limit (in percentage) applies:

Meas. chamber	Limit value
all	< 10 %

Table D-16 Standard deviation spec. evaluation

Electrode slope

Evaluates the sensitivity of the electrode/sensor to the sample medium.

Possible error causes: old, defective or contaminated electrodes.

With at least one error message, this test will result in *nor ok* – ☒ with the following items displayed.

Item	Description
Parameters	affected parameters Each parameter may be listed more than once due to different electrode status messages.
2P cal	number of parameter messages
Sensitivity low	number of parameter errors

Table D-17 Electrode slope details

The electrode slope is shown as number of errors in the selected period. For each parameter, the following limit (in percentage) applies:

Sensor	Limit value
all	0 % (no errors)

Table D-18 Electrode slope evaluation

Conductivity drift

Evaluates the drift of the conductivity in the BG or ISE measuring chamber as ratio from the conductivity at sample positioning to the conductivity when the measurement result is available.

Possible error causes: wetting problems, defective measuring chamber electronics, contamination in the measuring chamber.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Meas. chamber	affected measuring chamber
Conductivity meas.	number of measuring chamber messages
Drift too big	number of measuring chamber errors

Table D-19 Conductivity drift details

Theconductivity drift is shown as number of errors in the selected period. For each measuring chamber, the following limit (in percentage) applies:

Meas. chamber	Limit value
all	< 10 %

Table D-20 Standard deviation spec. evaluation

Temperature drift

Evaluates the stability of the temperature in the measuring chambers and in the SD-cartridge.

Possible error causes: defective heatings, power supply problems, defective fans.

Stability monitor limits

The stability monitor uses smaller limits than the applied limits to the instrument in order to recognize problems at an early stage.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Meas. chamber	affected measuring chamber
Temperature measurement	number of heating module messages
Deviation	number of heating module errors

Table D-21 Temperature drift details

The temperature drift is shown as number of errors in the selected period. For each module, the following limit (in percentage) applies:

Meas. chamber	Limit value
all	< 10 %

Table D-22 Standard deviation spec. evaluation

FMS stability

Evaluates the difference between produced FMS mixture concentration and measured mixture concentration.

Possible error causes: Defective main pump tubing, defective FMS tubing, defective FMS module.

Stability monitor limits

The stability monitor uses smaller limits than the applied limits to the instrument in order to recognize problems at an early stage.

Following items will be displayed in case of *nOk* – ☒.

Item	Description
Meas. chamber	affected measuring chamber
Cycles	number of FMS cycles for the measuring chamber
Error	number of FMS errors

Table D-23 FMS stability details

The FMS stability is shown as number of errors in the selected period. For each parameter, the following limit (in percentage) applies:

Meas. chamber	Limit value
all	< 8 %

Table D-24 FMS stability evaluation

Air pressure

This test will not be evaluated, therefore no details are available in the stability monitor. Use the *baro sensor test* for testing the baro sensor.

☞ At the ready screen, press
[System] > [Component test] > [Control sensors] > [Baro sensor].

The baro sensor value should be in a range of 526 mmHg < Value < 800 mmHg.

From approx. 3000 m above sea level or air pressure < 526 mmHg (70.13 kPa), the specifications for parameter PO_2 are no longer fulfilled and the parameter must no longer be used for evaluation of the clinical decisions.

After successful installation, the parameter must be permanently deactivated!

General hardware test

☞ At the ready screen, press [System] > [Diagnostics] > [General hardware test].

Overview This test is used to check the hardware components of the **cobas b** 221 system. This test allows any faults in components to be detected and limited (status *Ok* – ☑ / *nOk* – ☒). The following components are checked.

Starting the test ☞ Press [Start].

Printout At the result screen of the general hardware test, press ☞ [Print].

Power supplies

24V power supply

Error message: 24V power supply not nOk – ☒

Remedy:
- Check 24V cable (+ plug) from power supply to mainboard.
- Check actuator bus cable and plug.

12V power supply

Error message: 12V power supply nOk – ☒

Remedy:
- Check 12V cable (+ plug) from power supply to mainboard.

2.5V (MB)

Error message: 2.5V power supply nOk – ☒

Remedy:
- Check mainboard and if necessary replace.

Heatings

Heating BG

Error message: Peltier BG input nOk – ☒

Peltier BG output nOk – ☒

Remedy:
- Check cable plug from mainboard to BG module.
- Replace BG module.

Error message: Peltier fan BG input nOk – ☒

Peltier fan BG output nOk – ☒

Remedy:
- Check BG fan for mechanical blockage.
- Check cable plug from mainboard to BG module.
- Replace BG module.

Heating ISE

Error message: Peltier ISE input nOk – ☒

Peltier ISE output nOk – ☒

Remedy:
- Check cable plug from mainboard to ISE module.
- Replace ISE module.

Error message: Peltier fan ISE input nOk – ☒

Peltier fan ISE output nOk – ☒

Remedy:
- Check ISE fan for mechanical blockage.
- Check cable plug from mainboard to ISE module.
- Replace ISE module.

Heating MSS

Error message: Peltier MSS input nOk – ☒

Peltier MSS output nOk – ☒

Remedy:
- Check cable plug from mainboard to MSS module.
- Replace MSS module.

Error message: Peltier fan MSS input nOk – ☒

Peltier fan MSS output nOk – ☒

Remedy:
- Check MSS fan for mechanical blockage.
- Check cable plug from mainboard to MSS module.
- Replace MSS module.

Heating SD

Error message: Peltier SD 37°C-BG nOk – ☒

Peltier SD 37°C-ISE nOk – ☒

Peltier SD 37°C-MSS1 nOk – ☒

Peltier SD 37°C-MSS2 nOk – ☒

Remedy:
- Check cable plug from mainboard to sample distributor.
- Replace sample distributor.

Error message: Peltier fan SD 37°C at BG input nOk – ☒

Peltier fan SD 37°C at ISE input nOk – ☒

Peltier fan SD 37°C at MSS input nOk – ☒

Peltier fan SD 37°C above MSS input nOk – ☒

Remedy:
- Check SD fan for mechanical blockage.
- Check cable plug from mainboard to sample distributor.
- Replace sample distributor.

Valves on valve bus

Valve + No.

Error message: Valve + No. - nOk – ☒

Remedy:
- Check plug and cable of relevant valve.
- Replace valve.
- Replace valve board.

Turn & Dock

Stepper motor turn

Error message: T&D stepper motor turn nOk – ☒

Remedy:
- Check plug and cable of stepper motor.
- Replace stepper motor.

Stepper motor fillport

Error message: T&D stepper motor fillport nOk – ☒

Remedy:
- Check plug and cable of stepper motor.
- Replace stepper motor.

Stepper motor dock

Error message: T&D stepper motor dock nOk – ☒

Remedy:
- Check plug and cable of stepper motor.
- Replace stepper motor.

FMS

V19

Error message: Valve 19 nOk – ☒

Remedy:
- Check plug and cable of valve.
- Replace valve.
- Replace FMS control board.

VMIX

Error message: Valve MIX nOk – ☒

Remedy:
- Check plug and cable of valve.
- Replace valve.
- Replace FMS control board.

PP Main

Stepper motor main pump

Error message: Main pump nOk – ☒

Remedy:
- Check plug and cable of main pump.
- Replace main pump.
- Replace mainboard.

PP MSS

Stepper motor PP_MSS1 (In)

Error message: MSS pump 1 nOk – ☒

Remedy:
- Check plug and cable of MSS input pump.
- Replace MSS input pump.
- Replace mainboard.

Stepper motor PP_MSS2 (Out)

Error message: MSS pump 2 nOk – ☒

Remedy:
- Check plug and cable of MSS output pump.
- Replace MSS output pump.
- Replace mainboard.

Vacuum pump

V13

Error message: Valve 13 nOk – ☒

Remedy:
- Check plug and cable of valve.
- Replace valve.
- Replace vacuum control board.

V18

Error message: Valve 18 nOk – ☒

Remedy:
- Check plug and cable of valve.
- Replace valve.
- Replace vacuum control board.

Vacuum pump

Error message: Power supply of the vacuum pump nOk – ☒

Remedy:
- Check plug and cable of vacuum pump.
- Replace pump unit.
- Replace vacuum control board.

Main fan

Fan 1

Error message: Main fan 1 nOk – ☒

Remedy:
- Check fan unit for mechanical blockage.
- Check plug and cable of fan unit.
- Replace fan unit.
- Replace mainboard.

Fan 2

Error message: Main fan 2 nOk – ☒

Remedy:
- Check fan unit for mechanical blockage.
- Check plug and cable of fan unit.
- Replace fan unit.
- Replace mainboard.

Hemolyzer

Error byte Hemolyzer

Error message: Function of hemolyzer nOk – ☒

Remedy:
- Unscrew cap of hemolyzer, check hemolyzer for moisture and if necessary dry; then repeat test.
- Check plug and cable of hemolyzer.
- Replace hemolyzer.
- Replace HSIN board.

Service report

☞ At the ready screen, press [System] > [Diagnostics] > [Service report].

Overview The service report provides information about the sensor conditions as well as the FMX and COOX positioning times over a freely defined period or printed on-line over the printer. On each aspiration cycle the associated value flag is printed, in order to be able to notice cycle repetitions. If a drift alarm arises, then the current and the previous electrode status as well as the value flag are printed.

The default period for the service report are the last 6 hours.

Item	Description
Online	Activates (green) or deactivates (red) the output of all log monitor data at the internal thermal printer. If this function is activated, then no header is printed out. Measurement reports or QC reports interrupt the on-line printout, insert the appropriate report and continue the on-line printout again.

Table D-25 Overview of the service report

Deactivate the log monitor

Deactivate the log monitor in order to receive a contiguous printout of the service report. The on-line printout of the service report overlaps with that of the log monitor.

► To print the service report

1 Set the start day and start time as well as the stop day and stop time.

2 ☞ Press [Start].

After printing the header of the service report the printout of data will begin after some moments. The printout cannot be interrupted.

Sensor quality

The sensor quality shows the accomplished aspiration cycles and possible cycle repetitions and begins with the heading "Sensor quality" as well as date and time at the beginning of the calibration.

Additionally to the measuring parameters the following parameters are listed:

Parameter	Description
C A	conductivity CAL A BG/ISE
C B	conductivity CAL B BG/ISE

Table D-26 Additional parameters for the service report

One line per aspiration cycle shows the parameter status.

Per aspirating cycle one line each indicates the parameter status. The following cycles are considered:

Cycle	Description	Measurement chamber
LFB	conductivity CAL B	BG, ISE
LFC	conductivity CAL A	BG, ISE
1P	Mix1	BG, ISE
2P	Mix2	BG, ISE
AIR	O_2 air calibration	BG
NULL	O_2 zero point calibration	BG
D	calibration with MSS standby solution	MSS
C 1	CAL 1 calibration	MSS
C 2	CAL 2 calibration	MSS
C 3	CAL 3 calibration	MSS
C 4	CAL 4 calibration	MSS

Table D-27 Considered aspiration cycles for service report

The condition of each parameter is represented over a value flag which is listed in the column below the parameter name. The following informations are possible:

Condition	Description
–	parameter not relevant at this aspiration cycle
0	calibration OK
1	calibration OK (measurement value with extended specifications)
[*number*]	number of the value flag, which indicated the status after the aspiration cycle 👁 For details, see *Troubleshooting* on page D-3.

Table D-28 Considered aspiration cycles for service report

A calibration is represented by one or more lines in the service report.

Successfully during an aspiration cycle calibrated parameters get indicated with condition "0" or "1".

If further cycles are necessary, the reason for repetition can be read from the value flag. For details, see *Troubleshooting* on page D-3.

Standby BG

The standby section shows the sensor status during the standby phase and begins with the heading "Standby BG" as well as date and time at the beginning of the standby phase. This standby phase is not the standby mode of the instrument but the time in "Ready" mode while that is not being measured and not being calibrated. Every 10 minutes a new entry is print out.

👁 For details, see *Sensor limits (Sensor report)* on page D-135.

Status

If a drift alarm arises during the standby phase, the heading "Status" as well as date and time with the value flags for the measurement chamber concerned are print out.

👁 For details, see *Troubleshooting* on page D-3.

The status is followed by the entry *"Mix1"*.

Mix1

"Mix 1" will be printed out after the *"Status"* as well as date and time and indicates the last value which the concerned parameter measured with Mix1.

This enty can be compared with the last entry in the section *Status* in order to recognize the change in the signal characteristics.

FMS time

The FMS time is printed out with date and time in this section.

This is the time for the positioning of the solution CAL B from the FMS into the BG measuring chamber. In case there is no data available for the selected period the latest valid data from the log file will be printed.

	min	typ	max
FMS time	0 = 0 s	140 = 1,4 s	250 = 2,5 s

If the FMS time is very low, this indicates a blocked air tube at V19. If the FMS time is very high, this indicates a leakage in the FMS – BG measuiring chamber – main pump area: call up "General fluidics test" (☞ [System] > [Diagnostics] > [General fluidics test]).

SS3–Hemo Pos. Time

The SS3–hemolyzer positioning time is printed out with date and time in this section.

This is a counter for the positioning of the solution from the SS3 into the hemolyzer. In case there is no data available for the selected period the latest valid data from the log file will be printed.

	min	typ	max
SS3–Hemo Pos. Time	0 = 0 s	15 = 1,5 s	45 = 4,5 s

If the SS3–Hemo Pos. Time is very low, a too short tube between Hb cartridge and hemolyzer can be the cause. This tube is part of the Hb cartridge. If the SS3–Hemo Pos. Time is very high, an old main pump tube, a too long tube between Hb cartridge and hemolyzer or a leakage can be the cause.

Sensor limits (Sensor report)

☞ At the ready screen, press i > [Miscellaneous reports] > [Sensor report].

		min	typ	max
Conductivity BG	A Pot.	55 mV	75 mV	105 mV
	B Pot.	1320 mV	1500 mV	1710 mV
PCO_2	1P Pot.	-1300 mV	-1000 mV	2000 mV
	Slp Pot.	-160 mV	-143 mV	-110 mV
PO_2	1P Pot.	250 mV	330 mV	550 mV
	Slp Pot.	-10 mV	2 mV	15 mV
pH	1P Pot.	-2100 mV	500 mV	1600 mV
	Slp Pot.	-340 mV	-305 mV	-250 mV
Conductivity ISE	A Pot.	14 mV	50 mV	70 mV
	B Pot.	930 mV	1030 mV	1250 mV
Ca^{2+}	1P Pot.	-2000 mV	500 mV	2200 mV
	Slp Pot.	-95 mV	-87 mV	-65 mV
K^+	1P Pot.	-1700 mV	550 mV	2100 mV
	Slp Pot.	110 mV	130 mV	140 mV
Na^+	1P Pot.	-1700 mV	950 mV	2300 mV
	Slp Pot.	110 mV	130 mV	140 mV
Cl^-	1P Pot.	-2300 mV	700 mV	1700 mV
	Slp Pot.	-120 mV	-108 mV	-90 mV
Glu	1P Sens.	20 nA	90 nA	230 nA
	Lin	3.75	4.5	5.25
	3P Sens.	0 nA	10 nA	100 nA
Lac	1P Sen	20 nA	90 nA	260 nA
	Lin	3.75	4.5	5.25
	3P Sens	0 nA	10 nA	100 nA
BSA	1P Sen	-10 nA	0 nA	10 nA
	3P Sens	0 nA	10 nA	100 nA
Urea	1P Sens.	25 mV	31 mV	45 mV
	2P Sens.	35 mV	52 mV	75 mV
	Lin	1.6	1.7	1.9
Urea K^+	4P Sens.	10 mV	15 mV	25 mV
Urea NH_4^+	3P Sens.	8 mV	14 mV	32 mV
	4P Sens.	5 mV	12 mV	25 mV
COOX	d	60 µm	100 µm	130 µm
tHb/SO_2	Trans L1 - L4	30000	–	60000
	Stray L1 - L4	0	–	20000

Table D-29 Sensor limits

Sensor limits (Sensor report)

Glossary E

Glossary

A

Acid base diagram Based on the log PCO_2/pH-graph for the illustration of the transformed Henderson-Hasselbalch equation.

Alkaline Basic.

Analyzer Software mode for measuring, QC measurement, system, calibration, commonly used functions (quick access).

Arterial blood Blood taken from aorta.

AQC abbr. for AutoQC

AutoQC module The AutoQC module is a unit that enables to perform quality control measurements automatically.

AUTO-TROL PLUS B AutoQC material for controlling BG, ISE, Glu, Lac, Urea/BUN, COOX/Bilirubin.

AUTO-TROL TS+ AutoQC material for controlling BG, ISE, Glu, Lac, tHb/SO_2.

B

Barcode Scanner PS2 hand scanner with integrated decoder for an easy scanning of QC and electrode data, patient or user identity and of desired alphanumeric code.

BG abbr. for blood gas

BG measuring chamber The BG measuring chamber and its electrodes are used to measure the pH value and the blood gas values PO_2 and PCO_2.

Bilirubin Is a yellow decomposition product of the red blood pigment, hemoglobin, or more exactly, that of the hemoglobin share.

Bottle compartment The bottle compartment contains the waste water bottle (W Waste Container), the S1 Rinse Solution bottle, the S2 Fluid Pack (contains the solutions for BG and ISE) and the S3 Fluid Pack A (contains the solutions for Glu, Lac and Urea/BUN - **cobas b** 221<5/6> systems only).
In addition, the bottle compartment contains the necessary docking mechanisms for fluid transport into or out of the system.

Bottle tool To prevent spilling of the S1 solution. If the facility is 3000 m above sea level or higher deaerate the bottle before inserting to avoid splashing the S1 solution. As well as to empty the W waste container.

BUN abbr. for blood urea nitrogen

Bypass nipple This is the connection between the sample inlet path and the sample distributor.

C

Calibration for "Ready" The system automatically selects a calibration which will transfer all selected parame-ters to the state "Ready".

Contact clip The MSS cartridge in the Electrode holder is pushed into the correct position by the contact clip, thus anchoring it.

Clot Catcher Coagulate trap.

COMBITROL PLUS B QC material for controlling BG, ISE, Glu, Lac, Urea/BUN, COOX/Bilirubin.

COMBITROL TS+ QC material for controlling BG, ISE, Glu, Lac, Urea/BUN, COOX/Bilirubin.

COOX module The oximeter module is an optical sensor module for determining the total hemoglobin (tHb) and the hemoglobin derivatives oxyhemoglobin (O_2Hb), disoxyhemoglobin (HHb), carboxyhemoglobin (COHb), methemoglobin (MetHb) and bilirubin.

D

Docking mechanism These mechanisms are very easy to use and ensure optimum fluid transport.

Dummy electrode The dummy electrode is simply a flow electrode and is only intended as a spacer and it has no additional measuring functions.

E

Electrodes The electrodes are flow-through electrodes with a visible sample channel.

Electrode simulator Test device for the Measuring chamber.

F

Fill port The fill port allows injection or aspiration of samples from syringes, the Roche MICROSAMPLER, capillaries and ampoule adapters.

FMS Fluid mixing system. This system, together with the main pump ensures the correct mixture of calibration solutions CAL A and CAL B from the S2 Fluid Pack for subsequent calibrations using the valves VM and V19.

G

Glass tube see *Sample inlet path*

H

Hematokrit Abbr. Hct. The Hct is the cellular volume portion of the blood, which is occupied by the red blood cells, in relation to the volume of the whole blood.

Hemoglobin Hemoglobin is the main component of erythrocytes. It serves as the vehicle for transportation of oxygen within the bloodstream.

Hemolyzer In the hemolyzer, the sample is exposed to a strong ultrasonic field. The erythrocytes burst, releasing the hemoglobin.

Heparin salts Are the only clot inhibitors that may be used for analyses in the **cobas b** 221 system.

I

Input unit The sample insertion as well as the aspiration of solutions is carried out via input unit which consists of the T&D module and the sample drip tray.

ISE abbr. for ion sensitive electrodes

ISE measuring chamber The ISE measuring chamber and its sensors are used to measure the hematocrit value and the electrolyte values Na^+, K^+, Ca^{2+} and Cl^-.

L

Levey-Jennings graph QC statistics report.

LF abbr. (german) for conductivity

Linear bracket White plastic part of the peristaltic pump.

Locking lever This lever fixes the electrodes in the measuring chamber.

M

Measurement evaluation The validity of the test results from the instrument must be carefully examined by a clinical-medical specialist who will take the patient's clinical condition into consideration before any clinical decisions are reached based on the test results.

Measuring chamber Underneath the top cover are the BG and, depending on the configuration, the ISE measuring chamber with the electrodes and the MSS measuring chamber with the MSS cassette.

Measuring chamber cartridge The MC cartridge is used to transport the samples and calibration solutions to the wastewater system after measurement or calibration and also feeds in the reference solution and S1 Rinse Solution.

MC abbr. for "measuring chamber"

Module stop The error creates a message in the error window (upper right hand corner) on the display screen. This error is not a system stop. These errors identify individual issues affecting only a specific module of the analyzer and not the entire analyzer operation.

MSS cassette The MSS cartridge is a multiparameter sensor, which contains the spots of the displayed parameters.

MSS measuring chamber The MSS measuring chamber and its sensors are used to measure glucose, lactate and urea/BUN.

MSS abbr. for "metabolite sensitive sensor"

MSS polarisation A blood sample is inserted via fill port similar to a measurement. The MSS cassette is subsequently exposed to liquid and polarized.

Multirules The evaluation of QC results is based on the Westgard rules and their interpretation for blood gas analysis. The Multirule process was derived from these rules. It permits early detection of random and systematic errors associated with the measuring device and its operation.

N

NIST standards Are precise serums with accredited target values.

P

Patient trending map By means of this map, the course of individual parameters (measurement and calculation values) of a patient over any required period (standard setting = one day) can be shown and printed out.

Peristaltic pump see *Pumps*

Plasma Plasma samples are obtained by centrifuging heparinized whole blood, during which the cellular components of the blood are removed from plasma.

Plug control Infrared light barrier to detect attached/ removed sample container.

Polychromator The light is broken up and shown on the surface of a photosensitive receive (CCD – charge coupled device).

PP abbr. for peristaltic pump

Printer Low-noise thermoprinter with integrated paper cutter (manually activated using the "Cut" key) and optional winder.

Pumps Depending on the configuration, up to three peristaltic pumps transport the sample and the operating fluids inside the instrument (main pump, MSS output pump, MSS input pump).

Q

QC abbr. for quality control

QC material see *AUTO-TROL PLUS B*, *AUTO-TROL TS+*, *COMBITROL PLUS B*, *COMBITROL TS+*

Quality control A quality control program includes the analysis of sample materials with known ranges of expected values and the comparison of these values with analyzer results.

R

"Ready" screen Top level of the analyzer mode.

RCon abbr. for reference contact
RCon is used for Glu/Lac or Glu instrument variants and replaces the reference electrode and dummy.

Reference electrode The reference electrode must always produce the same signal, regardless of the sample's composition. This is achieved by mixing the sample flow with a liquid of a higher KCl concentration (reference solution).

Rubber sealing sealing of S2 Fluid Pack and depending on configuration S3 Fluid Pack A.

S

Sample distributor Is used for optimum temperature control and distribution of the samples and calibration solutions to the measurement modules. The sample distributor primarily consists of the sample distributor cartridge, the SD bypass nipple, the sample heating, the sample sensors and the drives of the distributor valves.

Sample inlet path Glass tube. Is used to transport fluids from the T&D disc through the needle to the sample distribution block (sample distributor).

Sample throughput Number of samples per hour.

Sample drip tray Prevents contamination of the bottle compartment (in case of improper sample introduction).

SCon abbr. for sensor contact
This electrode supports monitoring when filling the measuring chambers with fluid, without allowing the reference solution to return to the active electrodes.

Touch screen/PC unit The touch screen/PC unit serves as the graphical user interface. All information (results, error messages, alarms, warnings, etc.) is displayed on the screen. The screen consists of a color

LCD that is covered with a touch-sensitive film ("touch screen").

SIP abbr. for sample inlet path

S1 Rinse Solution To rinse the system.

S2 Fluid Pack Calibration solutions for BG and ISE.

S3 Fluid Pack A Calibration solutions for Glu, Lac, Urea/BUN.

SO_2 Oxygen saturation.

Status messages These messages define causes that affect the measurement values and/or calibration values of the analyzer.

System calibration Every 8, 12 or 24 hours (default) which includes Wavelength calibration of polychromator, cleaning with internal cleaning solution, Automatic conditioning of the Na^+ electrode (every 24 hours), Calibration of the mixing system and the 2 point calibration of all parameters.

System stop This error creates a window outlined in red halting the analyzer, the instrument stops.

System warning Only a warning whithout any action.

T

T&D module The T&D (Turn & Dock) module is used for sample input and for aspirating in solutions from S1, S2, S3 and the QC material from the AutoQC module. A comprehensive tube system allows quick and accurate distribution of the different fluids.
It consits of the T&D disk and tubing, sample container detection, sample inlet path (SIP) and fill port holder with fill port.

Tension lever Peristaltic pump's clear plastic cover.

tHb calibrator calibration solution with known tHb value to calibrate the COOX modul.

tHb/SO_2 module The tHb/SO_2 module is an optical sensor module for determining the levels of total hemoglobin (tHb) and oxygen saturation (SO_2) in whole blood.

Tonometered whole blood Whole blood was tonometered at 37 °C to various levels of gravimetrically prepared gases with CO_2 and O_2 concentrations certified to ± 0.03% absolute by the manufacturer. Expected and observed values for PCO_2 and PO_2 were corrected to 760 mmHg.

U

Urea (lat. Urea Pura) Urea is the most important catabolic product of the protein metabolism. It indicates a limited or insufficient kidney function (reduced or nonexistant filtration in cases of shock, heart failure, hypertonia, dehydration, tumours, etc.).

V

Vacuum pump The vacuum pump is responsible for washing and drying the tubes (with the exception of the measuring channel) and for aspirating calibration solutions over the T&D module.

Valve V19 Air mixture valve.

Valve VM Mixing valve for calibration solutions A (CAL A) and B (CAL B) from the S2 Fluid Pack.

Volume limitation Is the maximum volume of sample which is aspirated from the container.

W

W Waste Container Waste water.

Index F

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Versions G

8 Versions G-3

Versions

This chapter provides information about the released software versions and the released service manuals.

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Version 3.0 7
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Version 5.0 9
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Software

Version Nr.	Release Date	Remark
1.00	15.05.2003	First Release
1.02	29.09.2003	
1.04	19.11.2003	
2.00	12.03.2004	Mandatory upgrade
2.02	13.04.2004	
2.03	29.04.2004	Mandatory upgrade
3.00	09.06.2004	Mandatory upgrade
3.01	29.06.2004	
4.00	17.12.2004	
4.02	15.04.2005	
5.00	30.11.2005	
6.00	17.01.2007	
7.00	15.02.2008	
7.02	05.09.2008	

Table G-1 Software releases

Service Manual

Version 1.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
1.0	May 2003	First edition	1.0

Table G-2

Version 2.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
2.0	March 2004	2, 3, 4, 5, 6, 7, 8, 9	2.0

Table G-3

Chapter–Page	Modification / Addition
Cover Page	Version Nr. and Date
Table of contents	Update
2-1	Version list
3-I - 3-VI	Table of contents
3-11	Replacing the T&D linear actuators
3-12	Replacing the FMS
3-13	Replacing the FMS tubing set
3-15	Replacing the sample distributor
3-22	Replacing the MSS clip
3-25	Replacing the measuring chamber cartridge
3-28	Replacing the lamp unit bilirubin
3-30	Replacing the Polychromator Bilirubin
3-40	Replacing the pump head
3-42	Replacing the waste separator
3-45	Replacing the Transponder Control
3-46	Replacing the vacuum pump completely
3-50	Replacing the VP tube set
3-53 - 3-58	Valves
3-60	Replacing the Interface unit
3-63 - 3-69	Screen/PC unit
3-70	Replacing the Printer
3-72	Replacing the valve bus cable
4-I	Table of contents
4-1	Initial installation of the AutoQC module
4-2	Replacing the AutoQC module
4-4	Replacing the AQC magnetic valve

Table G-4

Chapter–Page	Modification / Addition
4-13	Replacing the AutoQC steel tube
4-14	Replacing the AQC temperature sensor
4-17	Replacing the toothed belt (long)
5-I	Table of contents
5-1 - 5-34	Fluid actions
6-I	Table of contents
6-1	Baro settings; Miscellaneous settings
6-3	COOX module
6-4	T&D needle calibration
6-5	Delete all databases
7-I	Table of contents
7-1	Maintenance
7-4	Maintenance
8-I	Table of contents
8-41	Troubleshooting
8-46	Troubleshooting
8-48 - 8-53	Important test routines
8-54 - 8-64	General fluidics test
9-1 to 9-4	Index

Table G-4

Version 3.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
3.0	June 2004	2, 3, 4, 6, 8, 9	3.01

Table G-5

Chapter–Page	Modification / Addition
Cover Page	Version Nr. and Date
Table of contents	Update
2-1	Version list
3-37	Replacing the tHb/SO_2 module
3-64	Replacing the Screen/PC Unit
3-66	Replacing the hard disk
6-1	Sample counter
6-2	Instrument type
6-3	COOX module
6-4	AVR-tools; Initialization; Shutdown PC
6-5	Simulation mode; AQC adjustment; Logmonitor-connection information
8-36	Value flag 2024 deleted
8-53	COOX (Roche OMNI S 2, 4, 6 only)

Table G-6

Chapter–Page	Modification / Addition
8-54	General fluidics test
8-68	General hardware test
9-1 to 9-4	Index

Table G-6

Version 4.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
4.0	December 2004	1, 2, 3, 6, 7, 8, 9	4.00

Table G-7

Chapter–Page	Modification / Addition
Cover Page	Text, Version Nr. and Date
Table of contents	Update
1-2, 1-3	Disinfectants
2-4	Version list
3-1	Note updated
3-37	tHb/SO_2 module replacement
3-38	Note inserted
3-41	Replacing the pump tube
3-64 to 3-66	Screen/PC unit
3-73	Software update with FTP
6-1	Baro settings
6-4	Protected system functions, protected infos, AQC adjustment
7-1, 7-4	Yearly replacement
8	System stops 10002, 10029, 10039, 10155, 10470 new
8	System stops 10005, 10028 modified
8	Module stops 20081, 20083 new
8	System warnings 30008-30011, 30028-30034 new
8	Value flags 3022, 3033, 4003, 4008, 4024, 8083, 8084, 9001, 9002, 9003, 9004, 9005, 9006, 9008, 9009, 9010 new
8	Value flags 1020-1024, 1032, 1036, 1038, 1050, 1051, 2009, 2011, 2012, 2016, 2021, 2022, 2028, 2031, 2040, 2041, 2043, 2044, 3000, 3004, 3013, 3014, 5010-5012, 6026, 8036, 8070, 8076 modified
8-54	Aggregates: T&D module
8-57 to 8-59	Measurement sensors: BG, ISE, MSS
9-1 to 9-4	Index

Table G-8

Version 4.1

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
4.1	July 2005	All chapters	4.02

Table G-9

Chapter–Page	Modification / Addition
Cover page	New: Edition notice
Cover page	New: Intended use
Cover page	New: Trademarks
Table of contents	Update:
Preface	Add: Preface
Preface	Add: How to Use Manual
Preface	Add: Where to Find Information
Preface	Add: Conventions used in this manual
Safety information	New chapter name: Chapter 'Introduction' was changed to 'Safety information'.
Glossary	New chapter:
Versions	New chapter:
Version	Add: Version 4.1
All chapters	• Add: 'Part' page (A - G) • Change: Chapter structure • Change: Paragraph style • Update: Table of Contents

Table G-10

Version 5.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
5.0	November 2005	see below	5.00

Table G-11

Part–Page	Modification / Addition
Table of contents	Updated
Version, Date	Update: Version 5.0, November 2005
8	Invisible laser radiation: new symbol
A-15	new fluidics graphics (all instrument configurations)
A-21	Pin assignment of S2 and S3 fluid packs: numbering removed
A-22	T&D positions new
A-41	MSS standby calibration modified
B-6	Protected setup: **cobas b** 221 settings new
B-8	USB functionality (service logfile export) new
B16	Tubing V4 – MC cartridge: new figure
B-22	T&D tubing set: figure changed
B-32, B-47	Replacing SD and MC cartridge: new note

Table G-12

Part–Page	Modification / Addition
B-41	Replacing MSS measuring chamber: procedure modified
B-53	Cuvette holder connections: new figure
B-76	Valves measuring chambe cartridge: figure changed
B-78	Valves sample distributor: figure changed
B-85	Mainboard unit: new figure
B-86	Sample sensor board: new figure
B-86, B-90, B-94	Compatibility chart and cross references new
B-90	Polychromator bilirubin code: procedure modified
B-101	Software update with USB mass storage new
B-108	Barcodescanner new
B-115	AutoQC preparation for maintenance new
D-3	General information new
D-12	System stops, module stops, system warnings, value flags modified
D-88	USB troubleshooting new
D-95	Vacuum system test modified
D-92	Aggregates: T&D needle calibration modified
D-96	Control sensors: sample sensors new
D-102	General fluidics test modified, new fluidics graphics
D-115	Stability monitor modified
D-126	Sensor limits (sensor report) modified
E	Glossary updated
G-5	Versions: Software versions added, revisions changed to versions
G-9	Version history: updated

Table G-12

Version 6.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
6.0	March 2006	see below	5.00

Table G-13

Part–Page	Modification / Addition
Title page	Replaced by **cobas** title page
cobas information page	Information page: new
Table of contents	Updated
Version, Date	Update: Version 6.0, March 2006
All parts and pages	Roche OMNI S replaced by **cobas b** 221 system
All parts	"cover" corrected to "top cover"
B-6	Instrument type: table and warning: new
B-66	Replacing the docking mechanisms S2 and S3 (fluid packs): step 5 modified
B-87	Figure B-64: updated
D-11	Error 10003: modified

Table G-14

Part–Page	Modification / Addition
D-16	Error 10032: modified
D-38	Errors 20032...20034: sequence modified
D-39	Error 20035: sequence modified
D-39	Errors 20048...20050: sequence modified
D-44	Errors 20087...20089: sequence modified
D-45	Error 20096: sequence modified
D-48	Warning 30005: modified
D-50	Warning 30015: modified
D-51	Warning 30016: modified
E-3 – E-6	Glossary updated with texts of Instructions for Use.

Table G-14

Version 7.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
7.0	December 2006	see below	6.00

Table G-15

Part–Page	Modification / Addition
Table of contents	Updated
Version, Date	Update: Version 7.0, November 2006
Edition Notice	Updated
A	Figure titles for fluid actuions overview, fluid packs and T&D positions added
A	Section "Decontamination" moved to part C, *Decontamination* on page C-5
A-5, B, C	Protective equipment: modified
A-9	Cleaning of modules and tubing: new
A-15 – A-46	Fluidics schematics (fluid actions): modified
B	"Calibration solution #" replaced by "CAL #"
B-9	Service log file export: note modified
B-19	Replacing the fill port, Replacing the fill port holder: naming modified
B-20	Replacing the sample inlet path: Figure B-6 *Replacing the sample inlet path* new
B-21	Replacing the bypass nipple: Figure B-7 *Replacing the bypass nipple* new
B-32	Replacing the sample distributor cartridge: Figure of bypass nipple replaced by cross reference
B-57	Replacing the cuvette holder: Figure B-40 *Cuvette holder* new
B-58	Replacing the cuvette seals: Figure B-41 *Cuvette seals* new
B-58, B-62	Replacing the tubing set tHb/PolyOX: modified
B-68	Waste separator: Figure B-49 *Waste separator* new
B-69	Waste docking mechanism: Figure B-50 *Waste docking mechanism* modified
B-69	Replacing the clamp docking mechanism: new
B-72	Replacing the vacuum pump head: modified
B-93	Figure B-69 *Touch screen/PC unit, interface unit and hard disk compatibility*: modified
B-107	Update of Video Sequences: cross references and description for USB new

Table G-16

Part–Page	Modification / Addition
C-5	Decontaminaten moved from part A; all sub sections updated
D	Error 10045, 10155; Error 20000, 20019, 20032...20034, 20035, 20048...20050, 20051, 20072, 20086, 20087...20089, 20096, 20142; Warning 30032, 30033: software text modified
D-19	Error 10046 "Waste line blocked": modified
D-24	Errors 10099...10106: description (first line) new
D-28	Error 10288: separated from Errors 10289...10294; Error 10288 modified
D-36	Error 10488: modified
D	Flag 1006, 1009: "Calibration solution #" replaced by "CAL #"
D-48	Error 20098: added
D-126	Service report: new

Table G-16

Version 8.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
8.0	December 2007	see below	7.00

Table G-17

Part–Page	Modification / Addition
Table of contents	Updated
Version, Date	Update: Version 8.0, December 2006
all	Instrument model notation: <x>/<y> modified to <x/y>
all	Software paths (in call-up of functions): modified to "☞ [System] > ..." (no "[Analyzer]")
A-19	Figure A-7: Pin assignment of S2 FluidPack and Figure A-7: Pin assignment of S2 FluidPack A: modified
B-5	Sample counter: updated; Logon with Operator ID: new; Bili: updated
B-7	Load default setup: new
B-11	System backup / restore: new
B-15	Chapter renamed to "Components" for readability
B-17	Folding up the central measuring unit: step 6: updated
B-77	Replacing the vacuum pump head: removed
B-93	Figure B-69: Touch screen/PC unit, interface unit and hard disk compatibility: updated
B-96, B-99	Replacing the touch screen/PC unit: cross reference to "System backup / restore" added Replacing the hard disk: updated
B-98	Figure B-77: better quality, speaker cable added
B-100	Replacing the TFT backlight: removed
B-133 B-134 B-137	Replacing the AutoQC steel tube, Replacing the AQC temperature sensor, Replacing the toothed belt (long): modified
C-10, C-11, C-12, C-13	Maintenance step: check vacuum system: yearly maintenance: new; three yearly maintenance: modified (instead of vacuum pump head)
D-11	Hard disk information: hard disk symbols: updated
D-12	**cobas** bge link screen sharing: updated

Table G-18

Part–Page	Modification / Addition
D-25	Error 10106 "Timing error": modified
D-37	Message 10489 "Remote lock": **cobas** bge link: updated Message 10491 "QC setup wizard active": new Message 10492 "Data transfer active": new
D-58	Warning 30037 "Screen sharing active": new
D-60	Flag 1007: check the "SS3-Hemo Pos. Time" added
D-92 – D-94	Touch screen/PC unit troubleshooting: new
D-98	T&D module test: T&D needle calibration: explanation updated
D-120	Stability monitor printout (example): new
D-121	Overview of the stability monitor: modified
D-123	Electrode voltage scanning: description modified
D-125	Conductivity drift: description modified
D-133	Service report: Table D-27: updated
D-134	FMS time, SS3–Hemo Pos. Time: updated

Table G-18

Version 9.0

Version Nr.	Date of Release	Modified Chapters	Applicable from Software Version
9.0	May 2009	see below	n/a

Table G-19

Part–Page	Modification / Addition
Table of contents	Updated
Version, Date	Update: Version 9.0, May 2009
A-19	Figure A-7: Pin assignment of S2 FluidPack and Figure A-8: Pin assignment of S2 FluidPack A: symbol of Fluid Pack added
B-5	Baro settings – factory settings: added Cross references at Error 10054, Flag 1052, 2028, 5006, 8076: updated
B-6	Measurement report operator ID: added
B-90	Mainboard connectors: DIP switch added
C-10 ff.	Maintenance lists: updated
D-13	Emergency routine: added
D-51	Warning 30005: updated
D-58	# ... check Hct result: added

Table G-20